MEMORANDUM FOR: The Record

FROM: Donald Knowles
Director, Office of Protected Resources

SUBJECT: Endangered Species Act Section 7 Biological Opinion on the Issuance of Section 10(a)(1)(A) Permits and Permit Modifications for Takes of Endangered Upper Columbia River Spring Chinook Salmon and Endangered Upper Columbia River Steelhead for the Purpose of Scientific Research--Consultation Number F/NWR/2001/00520

The attached ESA section 7 consultation on the issuance of ESA section 10(a)(1)(A) scientific research/monitoring permits and permit modifications to authorize annual takes of endangered Upper Columbia River spring chinook salmon and endangered Upper Columbia River steelhead (Consultation Number F/NWR/2001/00520) is issued. The National Marine Fisheries Service (NMFS) has determined that the issuance of each scientific research/monitoring permit and permit modification under section 10(a)(1)(A) of the ESA qualifies for a categorical exclusion under the National Environmental Policy Act, therefore, an Environmental Assessment or Environmental Impact Statement is not required for any of these actions. The attached consultation will be valid through December 31, 2005 unless superseded by another consultation.

NMFS concludes that issuing permits for the proposed research activities discussed in this consultation are not likely to jeopardize the continued existence of endangered Upper Columbia River spring chinook salmon or endangered Upper Columbia River steelhead or result in the destruction or adverse modification of the species' designated critical habitat. In arriving at this conclusion, NMFS considered comments from the Northwest Fisheries Science Center, NMFS as well as Federal and non-Federal technical experts and resource managers in the Northwest Region. These comments were incorporated within the consultation to the extent appropriate and feasible.

Attachment

Endangered Species Act Section 7
Consultation
and
Magnuson-Stevens Act
Essential Fish Habitat Consultation

BIOLOGICAL OPINION

Issuance of ESA Section 10(a)(1)(A) Permits and Permit Modifications for Scientific Research/Monitoring Involving ESA-listed Upper Columbia River Spring Chinook Salmon and ESA-listed Upper Columbia River Steelhead

Action Agencies: National Marine Fisheries Service
U.S. Geological Survey
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. Forest Service

Consultation Conducted By: National Marine Fisheries Service, Northwest Region
(Consultation Number F/NWR/2001/00520)

Date Issued: July 2, 2001

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I. Introduction and Consultation History

This document is the National Marine Fisheries Service's (NMFS) biological opinion on the review of proposed Endangered Species Act (ESA) section 10(a)(1)(A) permit applications described below, prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq). This biological opinion is based on information provided in the applications for the proposed permit actions, comments from reviewers including NMFS' Northwest Fisheries Science Center, published and unpublished scientific information on the biology and ecology of the endangered salmonids in the action area and other sources of information. A complete administrative record for each of the permit actions addressed in this consultation is on file with NMFS Protected Resources Division (PRD), Northwest Region (NWR), Portland, Oregon [F/NWR/2001/00520].

The proposed action is the issuance of 13 permits and permit modifications authorizing takes of endangered upper Columbia River (UCR) spring chinook salmon and endangered upper Columbia River (UCR) steelhead associated with scientific research/monitoring and/or enhancement activities. PRD NWR decided to group them in a single consultation pursuant to 50 CFR 402.14(c) because the proposed actions are similar in nature and will affect the same endangered species in the upper Columbia River Basin. Also, NMFS has considered similar research activities for the same area in previous group consultations described below.

On August 18, 1997, NMFS listed UCR steelhead (*Oncorhynchus mykiss*), both naturally-produced and artificially-propagated fish, as an endangered species under the ESA (NOAA 1997). NMFS concluded that the UCR steelhead Evolutionarily Significant Unit (ESU) is in danger of extinction throughout all or a significant portion of its range. NMFS also determined that one hatchery stock in the UCR Basin, the Wells Hatchery stock, should be considered part of the ESU, is currently essential for the recovery of the ESU, and should be listed under the ESA (NOAA 1997). The Washington Department of Fish and Wildlife (WDFW) operates the Wells Hatchery steelhead program. The final rule designating critical habitat for UCR steelhead was published on February 16, 2000 (NOAA 2000).

On April 10, 1998, NMFS issued a biological opinion on NMFS actions of issuing 19 ESA section 10(a)(1)(A) permits and permit modifications for scientific research and monitoring activities involving UCR steelhead for the period 1998-2002 (NMFS 1998a). This biological opinion supplements the April 10, 1998 opinion which is still valid.

On March 24, 1999, NMFS listed UCR spring chinook salmon (*Oncorhynchus tshawytscha*), both naturally-produced and artificially-propagated fish, as an endangered species under the ESA (NOAA 1999). In its final listing determination, NMFS concluded that the UCR spring chinook salmon ESU is in danger of extinction throughout all or a significant portion of its range. NMFS also determined that six hatchery stocks in the UCR Basin should be considered part of the ESU, are currently essential for the recovery of the ESU, and should be listed under the ESA (NOAA 1999). WDFW operates the hatchery programs for listed UCR spring chinook salmon. The final rule designating critical habitat for UCR spring chinook salmon was published on February 16, 2000 (NOAA 2000).

On November 12, 1999, NMFS issued a biological opinion on NMFS actions of issuing 19 ESA section 10(a)(1)(A) permits and permit modifications for scientific research and monitoring activities involving UCR spring chinook salmon for the period 1999-2003 (NMFS 1999c). This biological opinion supplements the November 12, 1999 opinion which is still valid.

The applicants for the new permits (listed in Section II.B. below) request multi-year permits to expire on December 31, 2005. The permits for which modifications are pending (listed in Section II.A. below), will expire on December 31, 2002 or 2003. NMFS expects that the holders of those permits will request extensions through December 31, 2005 or apply for new permits when the existing permits expire. Because the proposed research activities will affect the same species and be conducted in the same general areas, NMFS intends this opinion to be valid until December 31, 2005, and proposes to issue all the permit actions with expiration dates of December 31, 2005. If the status of the species change, new information is received, or other circumstances contemplated by the reinitiation provisions arise, NMFS will update this opinion. NMFS also has the ability to modify or suspend permits based on new or different conditions, and can alter take authorizations as needed.

Some of the proposed research activities may affect threatened bull trout (*Salvelinus confluentus*) if that species is likely to be present in the area where the research is taking place. Permit applicants are required to obtain a take authorization from the U.S. Fish and Wildlife Service (FWS) if threatened bull trout are expected to be encountered during research activities.

II. Description of the Proposed Actions

NMFS proposes to issue or modify 13 permits, pursuant to section 10(a)(1)(A) of the ESA. All of the permits would authorize take of endangered, naturally-produced and artificially-propagated,[1] UCR spring chinook salmon and/or endangered, naturally-produced and artificially-propagated, UCR steelhead. The studies identified in the proposed permit actions will be funded by several Federal agencies including NMFS, USFWS, and U.S. Environmental Protection Agency. Therefore the proposed actions for this opinion include the funding activities so that the funding agencies comply with section 7 of the ESA.

The permit applications propose the following types of research and monitoring activities: (1) Physiological testing of fish condition during collection, bypass, and transportation; (2) determining fish distribution and habitat requirements through juvenile and adult salmonid surveys; (3) monitoring the condition of juvenile salmon and steelhead and investigating the migration timing and requirements of juvenile and adult salmonids; (4) determining adult escapement and juvenile production in tributaries; (5) monitoring adult and juvenile salmon and steelhead passage through dams and reservoirs; (6) determining efficiency of juvenile bypass facilities; (7) conducting habitat restoration studies; (8) conducting genetic monitoring studies using tissue or scale samples; (9) determining the status of supplementation efforts and their

[1] Under NMFS policy, the progeny of hatchery and wild crosses are generally considered listed species for purposes of the ESA (58 FR 17573, April 5, 1993). Artificially-propagated UCR steelhead and UCR spring chinook salmon qualify as listed species under this policy and are therefore considered in the analyses throughout this biological opinion.

impact on the recovery of naturally-produced salmon and steelhead; (10) identifying factors contributing to juvenile salmon and steelhead stranding; (11) assessing the prevalence of disease; and (12) determining the biological effects of gas supersaturation. In addition, a number of research projects will focus on monitoring and evaluating management actions and tasks that are recommended for the recovery of ESA-listed salmon and steelhead populations.

These activities would involve harassing (e.g., passive observation by snorkeling or video camera, spawning ground surveys, delaying adult fish at barriers), capturing, trapping, handling, tagging, marking, holding, and sacrificing ESA-listed salmon and steelhead. Methods of capturing fish include trapping in a weir, trap box, or other containment associated with a fish barrier, seining or netting, and electrofishing. The types of tags and/or marks likely to be used include passive integrated transponders (PIT), radio transmitters, fin clips, cheek tags, and/or balloon tags. Researchers will collect tissues and scale samples from live fish and fish carcasses and transferred to a number of laboratories for archival and/or genetic analysis.

The permit applications contain specific information related to each of the proposed activities, including citations of literature that discuss some of the impacts of proposed activities and methodologies on fish. A general description of the activities associated with each proposed permit action follows. The take described is primarily in the form of capture, handling of fish, observation and harassment.

A. Proposed Modifications to Existing Permits

1. Permit 1114 Modification 3

Permit 1114 authorizes WDFW annual take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with two studies involving a smolt monitoring program at Rock Island Dam on the Columbia River. The purpose of the program is to collect information on adult and juvenile fish migration timing, survival, travel timing, and general fish health. The data will be used to make in-season adjustments to water releases from upstream reservoirs that optimize downstream migration conditions and to design operational measures to enhance adult passage survival at the dam..

For Modification 3, WDFW requests annual take of ESA-listed adult steelhead associated with a new study designed to evaluate steelhead migratory behavior, spawning distribution, hydroelectric project passage at the five hydropower dams on the upper Columbia River (Priest Rapids, Wanapum, Rock Island, Rocky Reach, and Wells), between dam losses, and tributary turnoff and fallback rates (WDFW 1999b). The goal of the study is to assure that safe passage conditions are being provided for returning ESA-listed adult fish at the dams. WDFW proposes to capture up to 400 ESA-listed adult steelhead annually at Priest Rapids Dam, tagged with gastrically-implanted radiotransmitters, transported, released, and tracked electronically as they migrate upstream. WDFW estimates that approximately 16 percent (up to 64) of the adult steelhead proposed to be tagged annually would be of natural origin and that approximately 84 percent (up to 336) would be of hatchery origin.

The radio-tagging study will be conducted in conjunction with the stock assessment sampling that occurs at Priest Rapids Dam under the authority of WDFW's scientific research/enhancement Permit 1094. Tagging will take place two days a week beginning in July and ending in October, in proportion to the run at large passing Priest Rapids Dam. Anesthetized adults will be allowed to recover in freshwater circulating in fish transport trucks then transported 15 kilometers downstream and released upstream of Vernita Bridge. Fixed station telemetry monitoring will begin in July and end in mid-November each year. Aerial surveys will begin in November and take place twice a month from Vernita Bridge to Chief Joseph Dam and in the Wenatchee, Entiat, Methow, and Okanogan tributary systems. WDFW has requested that Grant County Public Utility District (PUD), Chelan County PUD, and Douglas County PUD act as agents of WDFW in tracking the ESA-listed adults upstream. WDFW's experience with this type of research shows that indirect mortalities should not exceed 1 percent of the ESA-listed adult steelhead to be tagged or no more than 4 ESA-listed adult steelhead.

2. Permit 1115 Modification 3

Permit 1115 authorizes the Chelan County PUD to take adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult; and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the following six scientific research projects conducted at Rocky Reach and Rock Island Dams on the mainstem Columbia River and the Lake Chelan hydroelectric project: (1) to evaluate the juvenile fish bypass systems at the mainstem river dams, (2) to monitor juvenile fish gas bubble trauma at the mainstem river dams, (3) to develop operational measures that will enhance adult steelhead kelt passage survival at the mainstem river dams, (4) to evaluate new acoustic tagging technology used to monitor the behavior of juvenile salmonids as they migrate through passage facilities at Rocky Reach Dam, (5) to use PIT and radio-tagging technology to study the survival of juvenile steelhead at the mainstem river dams, and (6) to determine the types and numbers of adult salmonids that may be present in the Lake Chelan bypass reach after spill at the Lake Chelan hydroelectric project is curtailed and to identify a mitigation strategy to protect anadromous and resident fish that may become stranded in the bypass reach after spill is curtailed. Results from the scientific research are used to improve the operation of fish passage facilities at the dams, determine how fish are affected by gas bubbles and what can be done to minimize gas bubble trauma, evaluate the relative benefits of PIT and radio tagging technologies, assess the relative survival of juvenile salmonids subjected to surface collection bypass apparatus at the dams, determine the types and numbers of adult salmonids that may be present in the Lake Chelan bypass reach after spill at the Lake Chelan hydroelectric project is curtailed, and identify a mitigation strategy to protect anadromous and resident fish that may become stranded in the Lake Chelan bypass reach after spill is curtailed. ESA-listed juvenile fish are captured, examined or marked with fin clips or tagged with passive integrated transponders or acoustic tags, and released. ESA-listed adult fish are observed during snorkel surveys in the Lake Chelan bypass reach. If any adult salmonids are observed in the Lake Chelan bypass reach, the fish are captured, handled to obtain scientific information, and released.

For Modification 3, Chelan County PUD requests annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with: (1) snorkel surveys in the Chiwawa River, White River, Nason Creek, and the Little

Wenatchee River; and (2) spawning ground surveys in these same locations, as part of the on-going assessment of UCR spring chinook salmon production from the Rock Island Phase I hatchery program (Chelan County PUD 1999). Chelan County PUD funds the Rock Island Phase I hatchery program.

The densities and the total number of chinook salmon and trout as an index of freshwater production in the Chiwawa River Basin are assessed by first describing distinctive ecologic, geologic, geomorphic, and state or condition land-classes of streams in the basin that are used by chinook salmon (Hillman 1999). These same classification methods are used to identify sections of reference stream areas in the Wenatchee River Basin that correspond to discrete reaches in the Chiwawa River, but that have no releases of hatchery-origin chinook salmon. Habitat types are then identified and quantified within each land-class or stream reach. Within each stream reach, at least three units of each habitat type are chosen for estimating densities of salmon and trout. Snorkel surveys are conducted to enumerate salmon and trout in each stream reach selected. Spawning ground surveys in the Wenatchee River Basin are conducted pursuant to the Rock Island Settlement Agreement as part of the Rock Island Phase I hatchery program assessment.

The spawning surveys are intended to describe the abundance, distribution, and timing of spawning activity, escapement estimates, and length/frequency of carcasses sampled for scale analysis (Mosey and Truscott 1999). Annual redd count surveys for spring and summer chinook salmon are conducted in the Wenatchee River Basin between August and mid-November. Chelan County PUD's proposed activities will involve the temporary harassment of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and steelhead using passive observation techniques such as instream snorkel surveys and walking surveys to observe fish, to count redds, and to collect ESA-listed fish carcasses. Tissue samples and scales will be acquired from fish carcasses and retained for archival and/or analysis or provided to WDFW for archival and/or analysis. NMFS will identify but not enumerate, the annual observe/harass take of ESA-listed fish in the permit. The PUD does not anticipate any ESA-listed fish mortalities as a result of these scientific research activities.

Also for Modification 3, Chelan County PUD requests an increase in the annual take of juvenile, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile, naturally-produced and artificially-propagated, UCR steelhead associated with Projects 1, 2, 4, and 5. Take increases are requested because Chelan County PUD is devoting more effort and resources to conduct the scientific research, and thus, more fish are being handled during the juvenile outmigration season. Take increases are also requested because in recent years, Chelan County PUD researchers have noticed that a large proportion of hatchery steelhead are in poor physical condition and the researchers have to sort through more fish to find test animals in good condition for study purposes. Also, Chelan County PUD may need to handle extra ESA-listed UCR spring chinook salmon juveniles as a contingency for the PIT tag survival studies in case non-listed summer chinook salmon become unavailable (Chelan County PUD 2001). The PUD also requests take of adult, endangered, UCR spring chinook salmon associated with a salvage operation at Rocky Reach Dam. ESA-listed adult chinook salmon that fallback after passing the dam tend to inadvertently enter the juvenile bypass system of the dam. The adult fish will be removed and transferred back to the river.

Chelan County PUD proposes the following increases to its take authorization: UCR spring chinook salmon adults - up to 50 collect for transport (salvage); naturally-produced UCR spring chinook salmon juveniles - up to 5,505 capture/handle/release, up to 1,527 capture/handle/tag/release; artificially-propagated UCR spring chinook salmon juveniles - up to 27,995 capture/handle/release and up to 9,223 capture/handle/tag/release; naturally-produced UCR steelhead juveniles - up to 5,450 capture/handle/release and up to 1,907 capture/handle/tag/release; artificially-propagated UCR steelhead juveniles - up to 21,293 capture/handle/release. The amount of proposed take was estimated using recent ten-year average wild production estimates from the Biological Assessment and Management Plan (BAMP 1998), hatchery production numbers in the Wenatchee and Methow River watersheds, and Chelan County PUD's relative sampling effort.

Chelan County PUD has also requested associated increases in ESA-listed juvenile fish indirect mortalities. Chelan County PUD's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 2 percent of the fish to be handled. Therefore, Chelan County PUD proposes the following increases in indirect mortalities: naturally-produced UCR spring chinook salmon juveniles - up to 141; artificially-propagated UCR spring chinook salmon juveniles - up to 744; naturally-produced UCR steelhead juveniles - up to 147; artificially-propagated UCR steelhead juveniles up to 426.

3. Permit 1119, Modification 2

Permit 1119 authorizes USFWS to take adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the following four scientific research studies: (1) to gather data on emerging juvenile salmon and steelhead in the Entiat River Basin; (2) to conduct snorkel surveys in the Wenatchee, Entiat, Methow, and Yakima River Basins as part of inventory and artificial structure monitoring projects; (3) to conduct spawning ground surveys in the Entiat River Basin; and (4) to evaluate the feasibility of restoring endangered UCR steelhead above barriers in Icicle Creek, a tributary of the Wenatchee River. The data obtained from the research is used to determine the survival and contribution of salmon and steelhead released from USFWS mitigation hatchery programs in Central Washington and to provide technical assistance to federal and state agencies, tribes, and interest groups using and managing aquatic resources in the mid- to upper Columbia River Basin. ESA-listed juvenile salmon and steelhead are captured with screw traps, handled, and released during the Entiat River outmigration timing study (Study 1). For Studies 2, 3, and 4, ESA-listed adult and juvenile salmon and steelhead are observed during snorkel surveys and carcass surveys and adult carcasses are authorized to be handled. Also for Study 4, USFWS is authorized to capture, handle, and release ESA-listed adult steelhead above the Icicle Creek barriers, or capture, tag with radiotransmitters, release above the Icicle Creek barriers, and track them electronically.

For Modification 2, USFWS requests an increase in the annual take of ESA-listed juvenile steelhead associated with Study 1 because USFWS determined that the current level of steelhead take for Study 1 in Permit 1119 is not enough to conduct a statistically valid assessment of the juvenile steelhead emigration from the Entiat River throughout the annual outmigration season (USFWS 2000). USFWS proposes the following take increases: naturally-produced UCR steelhead juveniles - up to 266 capture/handle/release; artificially-propagated UCR steelhead

juveniles - up to 334 capture/handle/release. ESA-listed juvenile steelhead will be captured with a rotary-screw trap, sampled for biological information, and released. USFWS also requests to obtain tissue samples from ESA-listed adult spring chinook salmon carcasses in the Entiat River Basin that are authorized to be handled under the current permit and from the ESA-listed juvenile spring chinook salmon that are authorized to be handled in the current permit. Tissue samples are proposed to be transferred to NMFS for genetic analysis. USFWS also requests an associated increase in ESA-listed juvenile steelhead indirect mortalities. USFWS's experience with this type of research shows that the indirect mortality level should not exceed 2 percent of the ESA-listed steelhead to be handled or no more than an additional 5 juvenile, endangered, naturally-produced, UCR steelhead indirect mortalities and no more than an additional 7 juvenile, endangered, artificially-propagated, UCR steelhead indirect mortalities.

4. Permit 1141, Modification 2

Permit 1141 authorizes Grant County PUD annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with four scientific research studies in the area of Wanapum and Priest Rapids Dams located on the upper Columbia River. The purpose of Study 1 is to monitor outmigrating smolt condition at the dams, including the prevalence and severity of gas bubble disease. ESA-listed salmon and steelhead are captured at each dam with a butterfly dip net, anesthetized, examined and measured, and released downstream of each dam after being allowed to recover. The purpose of Study 2 is to substantiate and document hydroacoustic accuracy at Wanapum Dam. ESA-listed juvenile steelhead are authorized to be taken lethally as part of the hydroacoustics research study. The purpose of Study 3 is to evaluate the relative abundance of ESA-listed fish inhabiting the Priest Rapids project area. ESA-listed salmon and steelhead are collected with electrofishing equipment, seines, gill nets or minnow traps; anesthetized; sampled for biological information; allowed to recover; and released. The purpose of Study 4 is to assess the survival of juvenile, endangered, artificially-propagated, UCR steelhead as they migrate past Wanapum and Priest Rapids Dams. ESA-listed juvenile steelhead are collected with dip nets at the dam gatewells, anesthetized, tagged with radiotransmitters, allowed to recover, released, and tracked electronically. The results of the research will benefit the ESA-listed species by providing information to assist facility operators to minimize adverse impacts to the fish as a consequence of hydropower dam operations, by helping to determine what improvements can be made at the dams to mitigate the adverse impacts, by providing information on the status of the fish inhabiting the project areas, and by providing dam operators with valuable information on the survival of ESA-listed anadromous fish in the UCR Basin.

For Modification 2, Grant County PUD requests an annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with fish salvage efforts at Wanapum and Priest Rapids Dams. Each year, downstream migrating fish are inadvertently entrained within the projects' wheelgate bulkhead gatewell slots during the spring and summer migrations. Without assistance, the fish would remain within the gatewells for periods ranging from a few days to weeks and even months (Grant County PUD 1998). Migrating fish, including some downstream migrating steelhead kelts, will be removed from the gatewells via boom truck, gatewell dip-net, hopper box, or sanctuary box and

transported to a temporary holding tank until release. Permit 1141 already authorizes an annual take of ESA-listed steelhead kelts.

Grant County PUD also requests annual take of ESA-listed juvenile fish associated with efforts to monitor the condition of smolts subjected to salvage. The PUD proposes to capture, examine, and release ESA-listed juvenile fish. It request the following annual take levels associated with its proposed salvage operations: UCR spring chinook salmon adults - up to 5 collect for transport (salvage); naturally-produced UCR spring chinook salmon juveniles - up to 37,000 collect for transport (salvage) and up to 23,000 capture/handle/release; artificially-propagated UCR spring chinook salmon juveniles - up to 333,000 collect for transport (salvage) and up to 207,000 capture/handle/release; naturally-produced UCR steelhead juveniles - up to 39,000 collect for transport (salvage) and up to 14,000 capture/handle/release; artificially-propagated UCR steelhead juveniles - up to 91,000 collect for transport (salvage) and up to 41,500 capture/handle/release. The PUD also requests take of ESA-listed juvenile fish indirect mortalities associated with the proposed fish salvage operations. Grant County PUD's experience with this type of salvage activity shows that the indirect mortality level should not exceed 1 percent of the ESA-listed fish proposed to be handled. Therefore, Grant County PUD requests the following indirect mortality levels associated with fish salvage operations: naturally-produced UCR spring chinook salmon juveniles - up to 600; artificially-propagated UCR spring chinook salmon juveniles - up to 5,400; naturally-produced UCR steelhead juveniles - up tp 530; artificially-propagated UCR steelhead juveniles - up to 1,325.

Also for Modification 2, Grant County PUD proposes an increase in the annual take of juvenile, endangered, artificially propagated, UCR steelhead associated with Study 4 because Grant County PUD needs to increase the precision levels of the survival information obtained in previous years (Grant County PUD 2000). Grant County PUD proposes the following juvenile, endangered, artificially-propagated, UCR steelhead take increases: - up to 1,600 capture/handle/release and up to 740 capture/handle/tag/release. Researchers will capture, anesthetize, tag ESA-listed juvenile steelhead with radiotransmitters, and then allow them to recover, be released, and tracked electronically. The PUD also requests an associated increase in ESA-listed juvenile steelhead indirect mortalities. Grant County PUD's experience with this type of research shows that the indirect mortality level should not exceed 2 percent of the ESA-listed steelhead proposed to be handled or no more than an additional 47 juvenile, endangered, artificially-propagated, UCR steelhead indirect mortalities. In addition, Grant County PUD proposes to tag ESA-listed steelhead indirect mortalities with radiotransmitters and release the tagged carcasses downstream to identify any incidence of false positive detections at the monitoring stations below the dams.

5. Permit 1156, Modification 1

Permit 1156 authorizes the U.S. Environmental Protection Agency (EPA) and Dynamac Corporation annual takes of juvenile, threatened, naturally-produced and artificially-propagated, Snake River (SnR) spring/summer chinook salmon (*Oncorhynchus tshawytscha*); juvenile, threatened, SnR fall chinook salmon (*Oncorhynchus tshawytscha*); and juvenile, threatened, southern Oregon/northern California coast (SONCC) coho salmon (*Oncorhynchus kisutch*) associated with research designed to assess status and trends in the surface waters of the Pacific

Northwest in a statistically and ecologically rigorous manner as mandated by the Clean Water Act. EPA conducts surveys for fish, macroinvertebrate, algae, and microbial assemblages as well as physical and chemical habitat conditions in randomly-selected river systems in Oregon, Washington, and Idaho. During the course of the surveys, ESA-listed juvenile fish are captured by electrofishing (using backpack or raft-mounted gear), examined, and released. The research will benefit the ESA-listed species by providing baseline information to support enforcement of the Clean Water Act in freshwater river systems where ESA-listed fish may be present. Dynamac Corporation is a cooperator with the scientific research and its biologists are authorized to act as agents of EPA in conducting the research.

For Modification 1, EPA proposes an annual take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the research due to an expansion of the scope of the project (EPA/Dynamac 2000). EPA requests the following annual take levels: - up to 35 naturally-produced UCR spring chinook salmon juveniles, - up to 35 artificially-propagated UCR spring chinook salmon juveniles, - up to 45 naturally-produced UCR steelhead juveniles, and - up to 45 artificially-propagated UCR steelhead juveniles. ESA-listed juvenile fish will be captured by electrofishing, examined, and released. EPA's experience with this type of research shows that the indirect mortality level should not exceed 2 percent of the ESA-listed fish proposed to be handled or no more than 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon; no more than 1 juvenile, endangered, artificially-propagated, UCR spring chinook salmon; no more than 1 juvenile, endangered, naturally-produced, UCR steelhead; and no more than 1 juvenile, endangered, artificially-propagated, UCR steelhead. EPA has also requested an incidental take of ESA-listed adult spring chinook salmon and ESA-listed adult steelhead associated with the scientific research (see Incidental Take Statement). EPA has also requested that the Washington Department of Ecology be allowed to act as an agent of EPA under the permit while conducting the scientific research.

6. Permit 1203, Modification 1

Permit 1203 authorizes WDFW annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with five research studies in UCR tributaries and the mainstem Columbia River. The purpose of Study 1 is to assess the production of migrating juvenile salmonid populations in the Chiwawa and Wenatchee Rivers by sampling juvenile chinook salmon non-lethally for biological information and tissue samples. The purpose of Study 2 is to assess the escapement of returning adult spring chinook salmon by trapping the adult salmon at the fish ladders at Priest Rapids, Wells, Dryden, and Tumwater Dams; sample them for biological information; and release them upstream. The purpose of Study 3 is to survey the spawning grounds in the Methow, Okanogan, and Similkameen River Basins to identify chinook salmon and steelhead redds and collect biological data and tissue samples from ESA-listed adult chinook salmon carcasses. The purpose of Study 4 is to assess the capacity of salmonid habitat in the Methow, Entiat, and Wenatchee Rivers and their tributaries. Juvenile salmonids are captured using electroshockers, seines, and other techniques; anesthetized; sampled for biological data; and released. The purpose of Study 5 is to conduct presence/absence surveys associated with state Hydraulic Project Approvals in various watersheds of the UCR Basin. WDFW habitat biologists conduct

numerous site-by-site project assessments to determine potential project impacts or benefits to fish and their habitats. Habitat evaluations may include occasional electroshocking to document salmonid presence/absence and/or habitat utilization. Data from these five studies provide managers with valuable information that is used to assess the survival of migrating juvenile salmonids, the abundance of adults on spawning grounds, the annual success of spawners, and the relative abundance of salmonids in the available habitat. Most of the monitoring and evaluation activities that are directed at spring chinook salmon are included within the Mid-Columbia Mainstem Conservation Plan (MCMCP), a conservation planning initiative designed to recover salmonid populations upstream of Rock Island Dam to self-sustaining levels.

For Modification 1, WDFW requests added take of juvenile, endangered, artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead to Study 1. During the conduct of smolt trapping operations to assess wild juvenile spring chinook salmon production in the Wenatchee River Basin. WDFW researchers will collect and tag, and/or fin-clip or sample ESA-listed adult and juvenile steelhead for biological information. Also, WDFW proposes operating a juvenile smolt trap at a new location in the lower Wenatchee River (Monitor, WA at Rkm 9.6) for the purpose of monitoring the production of ESA-listed spring chinook salmon, ESA-listed steelhead (including post-spawned, outmigrating kelts), and ESA-listed bull trout, as well as all non-listed smolts produced in the basin (WDFW 2000).

WDFW requests an increase in take of juvenile, endangered, naturally-produced, UCR spring chinook salmon for Study 1. For Study 3, WDFW requests annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and adult and juvenile, endangered, artificially-propagated, UCR steelhead (WDFW 2000). For Studies 4 and 5, WDFW requests annual take of juvenile, endangered, naturally-produced, UCR steelhead (WDFW 2000). Also, WDFW requests take of ESA-listed adult and juvenile salmon and steelhead associated with efforts to salvage trapped fish from dewatered areas in the Wenatchee River Basin (WDFW 2001).

WDFW proposes the following take increases and additions: UCR spring chinook salmon adults - up to100 collect for transport (salvage); naturally-produced UCR spring chinook salmon juveniles - up to 5,000 collect for transport (salvage), up to 15,900 capture/handle/release and up to 4,800 capture/handle/tag/release; artificially-propagated UCR spring chinook salmon juveniles - up to 5,000 collect for transport (salvage), up to 11,850 capture/handle/release and up to 2,690 capture/handle/tag/release; UCR steelhead adults (kelts) - up to 100 collect for transport (salvage) and up to 30 capture/handle/release; naturally-produced UCR steelhead juveniles - up to 5,000 collect for transport (salvage), up to 4,900 capture/handle/release and up to 1,200 capture/handle/tag/release; artificially-propagated UCR steelhead juveniles - up to 5,000 collect for transport (salvage, up to, 21,020 capture/handle/release and up to 2,080 capture/handle/tag/release. The level of take of UCR spring chinook salmon and UCR steelhead was derived using survey data from previous years (WDFW 1999a) that reflect recent annual run sizes and productivity (and resultant fish collection and encounter levels), hatchery production numbers in the Wenatchee River watershed, and WDFW's proposed relative sampling effort.

WDFW has also requested associated increases in ESA-listed juvenile fish indirect mortalities. WDFW's experience with this type of research shows that the indirect mortality rate of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, WDFW proposes the following indirect mortality increases and additions: naturally-produced UCR spring chinook salmon juveniles - up to 771; artificially-propagated UCR spring chinook salmon juveniles - up to 586; naturally-produced UCR steelhead juveniles - up to 333; artificially-propagated UCR steelhead juveniles - up to 843. WDFW also requests 1 adult, endangered, UCR spring chinook salmon indirect mortality and 1 adult, endangered, UCR steelhead indirect mortality associated with salvage operations.

B. Proposed New Permits

1. Northern Wasco County People's Utility District - Permit 1229

Northern Wasco County People's Utility District (PUD) requests a permit for annual take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile endangered, naturally-produced and artificially-propagated, UCR steelhead for scientific research/monitoring activities at The Dalles Dam on the lower Columbia River. Permit 1229 will replace Permit 948 which expired on September 30, 1999. The annual take of UCR salmonids associated with Permit 948 was analyzed in both the April 10, 1998 UCR steelhead biological opinion and the November 12, 1999 UCR spring chinook salmon biological opinion cited previously. Northern Wasco County PUD is required to monitor the effectiveness of their fish passage facility at The Dalles Dam by the Federal Energy Regulatory Commission. The purpose of this ongoing monitoring effort is to examine the condition of juvenile fish passing through the facility, to maintain passage efficiency and minimize injury. Continued observation of individual fish passing through the screened intake channel during the smolt migration season provides specific information on possible unsuitable passage conditions below the water surface which are not directly observable. The PUD proposes to intercept ESA-listed juvenile salmonids in the screened turbine intake channel at the dam and convey them through a screened chute into an overflow screened tank. The juvenile salmonids will then be examined for external injuries and released (Northern Wasco County PUD 1999).

Northern Wasco County PUD proposes to handle up to 2 juvenile, endangered, naturally-produced, UCR spring chinook salmon; up to 15 juvenile, endangered, artificially-propagated, UCR spring chinook salmon; up to 4 juvenile, endangered, naturally-produced, UCR steelhead; and up to 21 juvenile, endangered, artificially-propagated, UCR steelhead. The PUD estimated the amount of UCR spring chinook salmon and UCR steelhead take by multiplying the 2000 juvenile salmonid outmigration estimates (Schiewe 2000) with the annual sampling effort required for the proposed research and monitoring (Northern Wasco County PUD 2000). Northern Wasco County PUD's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, Northern Wasco County PUD is requesting up to 1 juvenile, endangered, artificially-propagated, UCR spring chinook salmon indirect mortality and up to 1 juvenile, endangered, artificially-propagated, UCR steelhead indirect mortality.

2. Douglas County Public Utility District - Permit 1246

Douglas County Public Utility District (PUD) requests a permit for annual take of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with research designed to determine if the spring chinook salmon released from the Methow River Fish Hatchery (a mitigation hatchery for losses of juvenile salmon at Wells Dam) interact adversely with natural salmonid production in the Methow River Basin. Douglas County PUD proposes to conduct a monitoring program that will determine if hatchery-produced juveniles released from acclimation ponds impact naturally-rearing salmon and steelhead. The scientific research will provide information on the success of the hatchery program and the potential deleterious impacts to the recovery of ESA-listed chinook salmon and steelhead in the Methow River (Douglas County PUD 1999).

For the monitoring, the PUD proposes three scientific research tasks. The purpose of Task 1 is to determine if hatchery salmon are similar to natural salmon in spawning characteristics. Snorkeling surveys will be conducted to determine the upriver migration timing of natural spawners to their primary spawning reach(es) and to locate and describe the over-summer holding habitat used by natural spawners. The purposes of Task 2 are to compare the survival rates among various life stages of hatchery and natural spring chinook salmon in the natural river environment and to quantify the species' freshwater survival rates, parr production, and rearing densities. Spawning ground surveys will be conducted to determine the number of redds, spawn timing, and spawner distribution with regard to river discharge and total spawner escapement. The characteristics of the spawning sites and the microhabitat of individual redds dug by natural spawners will be determined. Also for Task 2, snorkel surveys will be used in the Chewuch River Basin to estimate late summer parr standing crop and parr habitat use.

For Tasks 1 and 2, Douglas County PUD's activities will involve the temporary harassment of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead using passive observation techniques such as instream snorkel surveys and walking surveys to observe fish and to count redds. ESA-listed fish carcasses will be collected and examined to estimate length and age distribution of spawners. In addition, the carcasses will be sampled for tissues and/or scales and coded-wire tags will be obtained. Tissue samples and scales will be retained for archival and/or analysis or provided to WDFW or NMFS for archival and/or analysis. NMFS will identify, but not enumerate the annual observe/harass take of ESA-listed fish in the permit. No ESA-listed fish mortalities are expected from these passive observation activities. For Task 2, juvenile, endangered, naturally-produced, UCR spring chinook salmon will be captured (using traps, seines, or electrofishing), marked with a caudal fin clip, and released back into the capture area after recovery to estimate snorkeling efficiency. The PUD requests take authorization for indirect mortalities resulting from caudal fin marking activity.

The purpose of Task 3 is to characterize and quantify the spring outmigration of natural spring chinook salmon juveniles from the Twisp, Chewuch, and the lower Methow Rivers. The purpose of this research is to monitor natural production from the basin to determine if long-term changes to natural smolt and pre-smolt outmigration occur, due to the production from naturally

spawning hatchery adults (Douglas County PUD 1999). Researchers will capture ESA-listed juvenile fish (using beach seines, screw traps, or electroshockers), sample them for biological information, and/or mark them with fin clips, and release them. The PUD requests authorization for indirect mortalities resulting from this activity. A small number of outmigrating adult steelhead kelts are also expected to be captured and sampled for biological information during trapping operations. Douglas County PUD also requests some intentional lethal take of juvenile, endangered, naturally-produced, UCR spring chinook salmon for subsequent archival and/or genetic analysis. In addition, Douglas County PUD requests an annual take of ESA-listed juvenile salmon and steelhead associated with efforts to salvage trapped parr from dewatered areas in the Methow River Basin (Douglas County PUD 1999).

Douglas County PUD requests the following annual take: naturally-produced UCR spring chinook salmon juveniles - up to 8,000 collect for transport (salvage), up to 400 capture/handle/release and up to 1,500 capture/handle/tag/release; artificially-propagated UCR spring chinook salmon juveniles - up to 80 capture/handle/release and up to 300 capture/handle/tag/release; UCR steelhead adult kelts - up to 5 capture/handle/release; naturally-produced UCR steelhead juveniles - up to 250 collect for transport (salvage), up to 130 capture/handle/release and up to 80 capture/handle/tag/release; artificially-propagated UCR steelhead juveniles - up to 20 capture/handle/release and up to 150 capture/handle/tag/release. In addition, Douglas County PUD requests up to 50 lethal takes of juvenile, endangered, naturally-produced, UCR spring chinook salmon. The take levels of UCR spring chinook salmon and UCR steelhead were derived using survey data from previous years (Douglas County PUD 1999) that reflect recent annual run sizes and productivity (and resultant fish collection and encounter levels), hatchery production numbers in the Methow River watershed, and Douglas County PUD's proposed relative sampling effort. Douglas County PUD's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, Douglas County PUD proposes the following annual indirect mortality take: naturally-produced UCR spring chinook salmon juveniles - up to 297; artificially-propagated UCR spring chinook salmon juveniles - up to 11; naturally-produced UCR steelhead juveniles - up to 14; artificially-propagated UCR steelhead juveniles - up to 5. Douglas County PUD proposes to use indirect mortalities of juvenile, endangered, naturally-produced, UCR spring chinook salmon in the place of intentional lethal takes when possible.

3. Washington Department of Transportation - Permit 1252

The Washington Department of Transportation (WDOT) requests a permit for annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with presence/absence surveys in waterbodies crossed by or adjacent to state transportation systems (highways, railroads, or airports) in the State of WA. The surveys will be used to assess potential impacts of WDOT projects on ESA-listed fish species. The survey work will benefit the species by providing information that will enable WDOT to implement specific timing restrictions for in-water work windows and to implement best management practices designed to protect ESA-listed species. The surveys will also add to the knowledge base of where ESA-listed species are located (WDOT 2000). WDOT proposes to observe/harass ESA-listed juvenile fish during snorkel surveys or capture them (using dip nets,

seines, minnow traps, rod and reel, or electrofishing), handle, and release them. ESA-listed juvenile fish indirect mortalities are also requested.

WDOT proposes to use passive observation techniques when possible. In the event that direct capture techniques are necessary, WDOT requests the following annual takes: naturally-produced UCR spring chinook salmon juveniles - up to 12 capture/handle/release; artificially-propagated UCR spring chinook salmon juveniles - up to 20 capture/handle/release; naturally-produced UCR steelhead juveniles and up to 10 capture/handle/release; artificially-propagated UCR steelhead juveniles - up to 20 capture/handle/release. The take levels of UCR spring chinook salmon and UCR steelhead were derived using survey data from previous years (WDOT 2000) and WDOT's proposed relative sampling effort. WDOT's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, WDOT proposes the following annual indirect mortality levels: naturally-produced UCR spring chinook salmon juveniles - up to 1; artificially-propagated UCR spring chinook salmon juveniles - up to 1; naturally-produced UCR steelhead juveniles - up to 1; artificially-propagated UCR steelhead juveniles - up to 1.

4. Northwest Fisheries Science Center, NMFS - Permit 1290

The Fish Ecology Division of the Northwest Fisheries Science Center (NWFSC), requests a permit for annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced; and artificially-propagated, UCR steelhead associated with two scientific research studies to be conducted in the Columbia River estuary. The purpose of Study 1 is to evaluate the importance of the Columbia River estuary to baitfish populations and salmonid survival. The study will benefit ESA-listed salmonids by providing information on the relative relationship between baitfish (northern anchovy and pacific sardine) abundance and salmonid survival in the estuary and marine environments (NWFSC 2001). The purpose of the Study 2 is to determine the prevalence and intensity of pathogens in juvenile salmonids. The study will benefit ESA-listed salmonids by contributing information on the extent to which diseases affect the growth and survival of juvenile salmonids in the estuarine and early ocean environments (NWFSC 2000). Study 2 is intended to complement the pathogen research that is being conducted by the Environmental Conservation Division, NWFSC under scientific research Permit 1140. ESA-listed juvenile fish will be captured by purse seine or beach seine, handled (anesthetized, identified, and measured), and released or taken lethally. ESA-listed juvenile fish indirect mortalities (up to 1 percent of the ESA-listed juvenile fish handled) are also requested. However, any UCR spring chinook salmon juvenile indirect mortalities will be retained for Study 2 in the place of intentional lethal takes. NWFSC also requests the use of the juvenile bypass system at Bonneville Dam as a backup sampling location for Study 2 should the researcher not be able to collect enough test fish in the estuary or should sampling in the estuary not be possible.

NWFSC proposes the following annual takes: naturally-produced UCR spring chinook salmon juveniles - up to 21 capture/handle/release and up to 4 lethal takes; artificially-propagated UCR spring chinook salmon juveniles - up to 21 capture/handle/release and up to 6 lethal takes; naturally-produced UCR steelhead juveniles - up to 7 capture/handle/release; artificially-propagated UCR steelhead juveniles - up to 32 capture/handle/release. NWFSC estimated the amount of ESA-listed fish takes by using catch data reported by Dawley *et al.* (1985), catch data

from Hinton *et al.* (1995), and by multiplying the 2000 juvenile salmonid outmigration estimates (Schiewe 2000) with the annual sampling effort required for the proposed research (NWFSC 2001).

5. U.S. Geological Survey - Permit 1291

The Columbia River Research Laboratory, U.S. Geological Survey (USGS) requests a permit for annual takes of juvenile, endangered, naturally-produced; and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with scientific research at John Day, The Dalles, and Bonneville Dams on the lower Columbia River in the Pacific Northwest. The purpose of the research is to monitor juvenile fish movement, distribution, behavior, and survival from John Day Dam downstream past Bonneville Dam using radiotelemetry technology. The research will benefit ESA-listed fish species by providing information on spill effectiveness, forebay residence times, and guidance efficiency under various flow regimes that will allow Federal resource managers to make adjustments to bypass/collection structures to optimize downriver migrant survival at the hydropower projects (USGS 2001). The proposed research is intended to complement the research that is being conducted by USGS under scientific research Permit 1130. ESA-listed juvenile fish will be captured by Smolt Monitoring Program (SMP) personnel at Bonneville and/or John Day Dams, handled, and released or captured by SMP personnel, provided to USGS personnel, implanted with radio transmitters, transported, held for as long as 24 hours, released, and tracked electronically. USGS requests that SMP personnel be allowed to act as an agent of USGS under the proposed permit. USGS also requests take for ESA-listed juvenile fish indirect mortalities of ESA-listed juvenile fish associated with the research.

USGS proposes the following annual takes: naturally-produced UCR spring chinook salmon juveniles - up to 402 capture/handle/release; artificially-propagated UCR spring chinook salmon juveniles - up to 4,592 capture/handle/release; naturally-produced UCR steelhead juveniles - up to 1,511 capture/handle/release and up to 151 capture/handle/tag/release; artificially-propagated UCR steelhead juveniles - up to 10,662 capture/handle/release. USGS estimated the amount of UCR spring chinook salmon and UCR steelhead takes by multiplying the 2000 juvenile salmonid outmigration estimates (Schiewe 2000) with the annual sampling effort required for the proposed research (USGS 2001). USGS's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, USGS proposes the following annual indirect mortality levels: naturally-produced UCR spring chinook salmon juveniles - up to 12; artificially-propagated UCR spring chinook salmon juveniles - up to 138; naturally-produced UCR steelhead juveniles - up to 50; artificially-propagated UCR steelhead juveniles - up to 320.

6. U.S. Forest Service - Permit 1292

The Pacific Northwest Research Station of the U.S. Forest Service (USFS) requests a permit for annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with research to be conducted in the Yakima River, the Wenatchee River, the Entiat River, and the Methow River in WA. The purpose of the research is to determine the extent and distribution of hybridization between westslope cutthroat trout, rainbow trout, and anadromous steelhead for selected populations in the MCR and UCR Basins. The research will

benefit ESA-listed species by providing information on westslope cutthroat trout and rainbow trout/steelhead interactions and could provide insight into possible genetic introgression of introduced rainbow trout stocks in the areas of native rainbow trout/steelhead distribution. USFS also proposes to analyze phenotypic characteristics that may be used by biologists in the future to more definitively distinguish cutthroat trout, rainbow trout/steelhead, and hybrid forms in the field (USFS 2001). ESA-listed juvenile fish will be captured by the use of angling with flies that have barbless hooks. After being captured, the ESA-listed steelhead juveniles will be sampled non-lethally for caudal fin tissue and released. ESA-listed spring chinook salmon juveniles will be immediately released after being captured. USFS also requests take for indirect mortalities of ESA-listed juvenile fish associated with the research.

USFS proposes the following annual takes: Naturally-produced UCR spring chinook salmon juveniles - up to 34 capture/handle/release; artificially-propagated UCR spring chinook salmon juveniles - up to 133 capture/handle/release; naturally-produced UCR steelhead juveniles - up to 35 capture/handle/mark/release; artificially-propagated UCR steelhead juveniles - up to 137 capture/handle/mark/release. USFS estimated the amount of ESA-listed fish takes for the Wenatchee and Entiat River subbasins by multiplying the mean proportion of wild smolts counted at Rock Island Dam for 1986-1994 (Chapman *et al*. 1994) with the proposed sampling effort in those subbasins (USFS 2001). The amount of ESA-listed fish takes for the Methow River subbasin were estimated by multiplying the mean proportion of wild smolts counted at Wells Dam for 1986-1994 (Chapman *et al*. 1994) with the proposed sampling effort in the Methow River subbasin (USFS 2001). USFS's experience with this type of research shows that the indirect mortality level of ESA-listed juvenile fish should not exceed 3 percent of the fish proposed to be handled. Therefore, USFS proposes the following annual indirect mortality levels: naturally-produced UCR spring chinook salmon juveniles - up to 1; artificially-propagated UCR spring chinook salmon juveniles and up to 4; naturally-produced UCR steelhead juveniles - up to 1; artificially-propagated UCR steelhead juveniles - up to 4.

7. Northern Resource Consulting - Permit 1293

Northern Resource Consulting (NRC) requests a permit for annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with scientific research to be conducted in numerous headwater streams throughout OR and WA. The purpose of the research is to determine juvenile fish presence or absence on privately owned timberlands and to provide the Washington Department of Natural Resources, the Oregon Department of Forestry, and other state agencies with information to be used to update fish distribution maps. The research will benefit ESA-listed salmonids by providing information on the upper extent of fish usage in headwater streams, providing information on potential stream blockages which may inhibit anadromous fish migration, and providing information that will assist small landowners with culvert projects that could result in an increase in available fish habitat (NRC 2001). ESA-listed juvenile fish will be observed/harassed or captured (using electrofishing or angling), handled, and released. No lethal takes of ESA-listed anadromous fish species are requested.

NRC proposes to handle up to 4 juvenile, endangered, naturally-produced, UCR spring chinook salmon; up to 2 juvenile, endangered, artificially-propagated, UCR spring chinook salmon; up to

9 juvenile, endangered, naturally-produced, UCR steelhead; and up to 3 juvenile, endangered, artificially-propagated, UCR steelhead. The take levels of UCR spring chinook salmon and UCR steelhead were derived using survey data from previous years (NRC 2001) and NRC's proposed relative sampling effort.

C. Special Conditions and Requirements

NMFS proposes to issue all the permits with Special Conditions to require the implementation of specific protocols, procedures, and techniques that NMFS believes will minimize adverse effects and mortalities on ESA-listed fish associated with the scientific research activities. For example, one of the conditions requires researchers to handle ESA-listed fish with extreme care and kept in water to the maximum extent possible to reduce stress on the handled fish. There is also a prohibition against intentionally killing ESA-listed fish unless specifically authorized by the permit. Additional mitigation measures typically used by researchers can be found in the description of the actions and effects analysis that follow. Conditions designed to minimize and mitigate incidental takes of ESA-listed chinook salmon and steelhead are also described in the Incidental Take Statement of this consultation. A list of the Special Conditions to be placed in the permits is found in Appendix 1. In addition, each proposed multi-year permit will contain the requirement that permit holders submit an annual report after each sampling season that provides a description of the permit holder's activities, a summary of the actual ESA-listed fish take numbers for the season, the measures taken to minimize disturbances to ESA-listed fish, any preliminary analyses of the data, and a description of the steps that have been or will be taken to coordinate the research findings with other researchers. This will enable NMFS, the other action agency and permit holders to continue to assess the impacts of these activities. Annual reporting requirements are contained in Appendix 2.

D. Action Areas

The action area for endangered UCR spring chinook salmon is the UCR Basin including the species' designated critical habitat (NOAA 2000). Specifically, the action area for the species includes all river reaches accessible to chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River (see Figure 1). Also included are adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are tribal lands and areas above specific dams (e.g., Lake Chelan hydropower project) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for the UCR spring chinook salmon ESU comprise approximately 7,003 square miles in Washington. The following counties lie partially or wholly within these basins: Chelan, Douglas, Kittitas, and Okanogan.

The action area for endangered UCR steelhead is the UCR Basin including the species' designated critical habitat (NOAA 2000). Specifically, the action area for the species includes all river reaches accessible to steelhead in Columbia River tributaries upstream of the Yakima River and downstream of Chief Joseph Dam in Washington (see Figure 2). Also included are

adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are tribal lands and areas above specific dams (e.g., Lake Chelan hydropower project) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for the UCR steelhead ESU comprise approximately 9,545 square miles in Washington. The following counties lie partially or wholly within these basins: Chelan, Douglas, Grant, Kittitas, Okanogan, and Yakima.

III. Status of Species Included in this Consultation

The actions considered in this biological opinion will affect UCR spring chinook salmon, currently listed as endangered, and UCR steelhead, currently listed as endangered. The listing status, life history, biological requirements, population trends, and habitat elements for these two species are described in Appendix 3 of this opinion. Information on the status and distribution of UCR spring chinook salmon is found in the status review prepared by the Northwest Fisheries Science Center, NMFS (Myers *et al*. 1998). More recent information on the status and distribution of the chinook salmon ESU, including hatchery components of the respective populations, is provided in the status review update prepared by the West Coast Chinook Salmon Biological Review Team (NMFS 1998c) and the Evaluation of the Status of Chinook and Chum Salmon and Steelhead Hatchery Populations for ESUs Identified in Final Listing Determinations prepared by the Conservation Biology Division of the NWFSC (NMFS 1999a). Information on critical habitat for endangered UCR spring chinook salmon is found in the *Federal Register* notice that designates critical habitat for these species (NOAA 2000).

Information on the status and distribution of UCR steelhead is found in the status review prepared by the Northwest Fisheries Science Center, NMFS (Busby *et al*. 1996). More recent information on the status and distribution of the steelhead ESU, including hatchery components of the respective populations, is provided in the status review update prepared by the West Coast Steelhead Biological Review Team (NMFS 1997) and the Evaluation of the Status of Chinook and Chum Salmon and Steelhead Hatchery Populations for ESUs Identified in Final Listing

[Insert UCR spring chinook salmon ESU map]

[Insert UCR Steelhead ESU map]

Determinations prepared by the Conservation Biology Division of the NWFSC, NMFS (NMFS 1999a). Information on critical habitat for endangered UCR steelhead is found in the *Federal Register* notice that designates critical habitat for these species (NOAA 2000). A summary of status and distribution of both ESA-listed fish follows.

A. UCR Spring Chinook Salmon

There are no estimates of historical abundance specific to this ESU. WDFW monitors nine spring-run chinook salmon stocks geographically located within this ESU. Escapements to most tributaries are monitored by redd counts, which are expanded to total live fish based on counts at mainstem Columbia River dams. Escapements continue to be critically low in all rivers and the redd counts are still declining severely. Long-term trends in estimated abundance are mostly downward, with annual rates of change ranging from -6 percent to +1 percent over the full data set. Harvest rates have been declining recently, and are estimated to be less than 10 percent (ODFW and WDFW 1995).

NMFS' primary concerns center on very low abundance and distribution and strongly negative trends and stock productivity for this ESU. The average recent adult escapement to the tributaries in the ESU (Chiwawa River, Methow River, Twisp River, Chewuch River, White River, Nason Creek) has been less than 5,000 hatchery and wild chinook salmon combined; all individual populations consist of less than 100 fish (NMFS 1998c). At these population sizes, the negative effects of demographic and genetic stochastic processes are likely. Furthermore, both long- and short-term trends in abundance are declining. The abundance of the spring chinook salmon returning to the Methow River Basin has been so low that all fish returning in 1996 and 1998 were intercepted at Wells Dam and were incorporated into artificial propagation programs at Methow Fish Hatchery. In addition, the captive broodstock programs underway on the Twisp and White Rivers and Nason Creek indicate the severity of the population declines.

Historical artificial propagation efforts have had a significant impact on spring-run chinook salmon populations in this ESU. Extensive introductions of spring-run chinook salmon from outside the ESU and within-ESU egg transfers that occurred in the past have left their mark on the genetic legacy of the fish remaining in the ESU. Artificial propagation recently has focused on supplementing naturally spawning populations in this ESU (Bugert 1996), although it should be emphasized that these naturally spawning populations were founded by the same homogenized stock produced during implementation of the Grand Coulee Fish Management Program (1939-1943). Furthermore, the potential exists for hatchery-derived non-native stocks to adversely affect naturally spawning populations. In addition, Howell *et al.* (1985), Chapman *et al.* (1991), Mullan *et al.* (1992), and Chapman *et al.* (1995) have suggested that the prevalence of bacterial kidney disease in upper Columbia and Snake River hatcheries is directly responsible for the low survival of hatchery stocks.

ESA-listed juvenile salmon abundance can vary considerably from year-to-year based on levels of adult escapement, natural fluctuations in environmental conditions, or anthropogenic effects. In an effort to estimate juvenile salmon abundance, the Northwest Fisheries Science Center, has developed an algorithm that is used each year to calculate juvenile salmon outmigration estimates. These estimates have become a standardized tool that is used by virtually all the

comanagers in the region to estimate annual ESA-listed juvenile fish takes associated with their respective activities. Table 3 (Appendix 4) provides the ESA-listed juvenile salmon outmigration estimates for 2001, including endangered UCR spring chinook salmon, at each of the hydropower dams on the mainstem Snake and Columbia Rivers (Schiewe 2001). For the analyses in this consultation, the estimates under the full transportation (no spill) scenario will be used since that is the applicable scenario for the 2001 outmigration season.

B. UCR Steelhead

Despite numerous efforts to halt and reverse declining trends in west coast steelhead, it is clear that the status of many native, naturally-producing populations has continued to deteriorate. NMFS therefore believes it highly likely that past efforts and programs to address the conservation needs of these stocks are inadequate, including efforts to reduce mortalities and improve the survival of these stocks through all stages of their life cycle. Important factors include the loss of habitat, continued decline in the productivity of freshwater habitat for a wide variety of reasons, significant potential negative impacts from interactions with hatchery stocks, overfishing, and natural environmental variability.

Estimates of historical (pre-1960s) abundance specific to the UCR steelhead ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700 , suggesting a pre-fishery run size in excess of 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.* 1994). Runs may have already been depressed by lower Columbia River fisheries at this time. Recent five-year (1989-1993) average natural escapements are available for two stock units: Wenatchee River, 800 steelhead, and Methow and Okanogan Rivers, 450 steelhead. Recent average total escapements for these stocks were 2,500 and 2,400 respectively. Average total run size at Priest Rapids Dam for the same period was approximately 9,600 adult steelhead. Trends in total (natural and hatchery) adult escapement are available for the Wenatchee River (2.6 percent annual increase, 1962-1993) and the Methow and Okanogan Rivers combined (12 percent annual decline, 1982-1993). These two stocks represent most of the escapement to natural spawning habitat within the range of the ESU; the Entiat River also has a small spawning run (WDF *et al.* 1993).

Steelhead in the upper Columbia River ESU continue to exhibit low abundances, both in absolute numbers and in relation to numbers of hatchery fish throughout the region. Data from this ESU include separate total and natural run sizes, allowing the separation of hatchery and natural fish abundance estimates for at least some areas in some years. A review of recent data indicates that natural steelhead abundance has declined or remained low and relatively constant in the major river basins in this ESU (Wenatchee, Methow, Okanogan) since the early 1990s. Estimates of natural production of steelhead in the ESU are well below replacement (approximately 0.3:1 adult replacement ratios estimated in the Wenatchee and Entiat Rivers). These data indicate that natural steelhead populations in the UCR Basin are not self-sustaining at the present time. The Biological Review Team also discussed anecdotal evidence that resident rainbow trout, which are in numerous streams throughout the region, contribute to anadromous run abundance. This phenomenon would reduce estimates of the natural steelhead replacement ratio.

The proportion of hatchery fish is high in these rivers (65-80 percent). In addition, substantial genetic mixing of populations within this ESU has occurred, both historically (as a result of the Grand Coulee Fish Management Program) and more recently as a result of the Wells Hatchery program. Extensive mixing of hatchery stocks throughout this ESU, along with the reduced opportunity for maintenance of locally adapted genetic lineages among different drainages, represents a considerable threat to steelhead in this region.

ESA-listed juvenile steelhead abundance can vary considerably from year-to-year based on levels of adult escapement, natural fluctuations in environmental conditions, or anthropogenic effects. In an effort to estimate juvenile steelhead abundance, the Northwest Fisheries Science Center, has developed an algorithm that is used each year to calculate juvenile steelhead outmigration estimates. These estimates have become a standardized tool that is used by virtually all the comanagers in the region to estimate annual ESA-listed juvenile fish takes associated with their respective activities. Table 4 (Appendix 4) provides the ESA-listed juvenile steelhead outmigration estimates for 2001, including endangered UCR steelhead, at each of the hydropower dams on the mainstem Snake and Columbia Rivers (Schiewe 2001). For the analyses in this consultation, the estimates under the full transportation (no spill) scenario will be used since that is the applicable scenario for the 2001 outmigration season.

IV. Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR402.02. The environmental baseline for this biological opinion includes the effects of several forms of activities, summarized below, that affect the survival and recovery of UCR spring chinook salmon and UCR steelhead. The biological requirements of both UCR spring chinook salmon and UCR steelhead are currently not being met under their respective environmental baselines. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines. In addition, there must be improvements to minimize impacts due to hydropower dams, incidental harvest, hatchery practices, and unfavorable estuarine and marine conditions.

The best scientific information presently available suggests that a multitude of factors, past and present, have contributed to the decline of west coast salmonids. NMFS reviewed much of that information in its recent Consultation on Operation of the Federal Columbia River Power System (FCRPS NMFS 2000), and that review is summarized here. NMFS recognizes that natural environmental fluctuations have likely played a role in the species' recent declines. However, NMFS believes that other human-induced impacts (e.g., harvest in certain fisheries, artificial propagation, water diversions, and widespread habitat modification) have played an equally significant role in the decline of these species. While at-risk salmonid stocks may benefit from a reversal in the current climate/ocean regime, resource managers need to focus on reducing impacts from harvest and artificial propagation and improving freshwater and estuarine habitats.

NMFS believes there is ample evidence to suggest that past destruction, modification, and curtailment of freshwater habitats has contributed to the decline of chinook salmon ESUs.

Examples of habitat alterations affecting chinook salmon include: water withdrawal, conveyance, storage, and flood control (resulting in insufficient flows, stranding, juvenile entrainment, and increased stream temperatures); logging and agriculture (resulting in loss of large woody debris, sedimentation, loss of riparian vegetation, and habitat simplification); and loss of habitat caused by the construction of dams. These human-induced impacts in freshwater ecosystems have likely reduced the species' resiliency to natural factors for decline such as drought and poor ocean conditions.

Other possible factors for decline of west coast chinook salmon populations include predation by marine mammals, birds, and non-native fish species; non-point and point source pollution caused by agriculture and urban development; disease outbreaks caused by hatchery introductions and warm water temperatures; mortality resulting from unscreened irrigation inlets; competition in estuaries between native and hatchery fish; and cumulative loss and alteration of wetlands and estuarine areas. In certain cases where pinniped populations co-occur with depressed salmon populations, salmon populations may experience severe impacts due to predation.

A. The Species' Biological Requirements in the Action Areas

UCR spring chinook salmon and UCR steelhead reside in, or migrate through, the action areas considered in this consultation. The biological requirements during the species' life history stages can be obtained by identifying the essential features of their critical habitat. Essential features include adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions (65 FR 773). As discussed below there are numerous factors affecting these requirements in the action area.

B. Factors Affecting the Species in the Action Areas

1. Hydropower System Effects on the Baseline

Columbia River Basin anadromous salmonids have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS) on the lower Snake and Columbia Rivers and the PUD-operated dams on the UCR. Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia Rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate, affecting fish movement through reservoirs and riparian ecology, and stranding fish in shallow areas. The 13 dams in the migration corridor of the Snake and Columbia Rivers alter smolt and adult migrations. Smolts experience a high level of mortality passing the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts' journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor now depend far more on volume runoff than before the development of the mainstem reservoirs.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between NMFS and the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), USFWS, and the Bureau of Reclamation (BOR). The changes have improved survival for the ESA-listed fish migrating through the Snake and

Columbia Rivers. Increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia Rivers provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also been improved by the addition of new barges and modification of existing barges. In addition to spill, flow, and transportation improvements, the Corps implemented numerous other improvements to project operations and maintenance at all FCRPS dams on the Snake and Columbia Rivers.

It is possible to quantify the survival benefits accruing from many of these strategies for each of the ESA-listed anadromous fish ESUs. For Snake River spring/summer chinook salmon smolts migrating inriver, the estimated survival through the hydrosystem is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of 5 percent to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer chinook salmon (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all ESA-listed Columbia River Basin salmonids and that the benefits will be greater the farther upriver the ESU. However, further improvements are necessary because the Federal hydrosystem continues to cause a significant level of mortality for some ESUs.

Several non-Federal projects licensed by the Federal Energy Regulating Commission (FERC) also affect UCR spring chinook salmon and UCR steelhead on the mainstem Columbia River. Operations of the Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams are currently governed by existing FERC license requirements and settlement agreements. Each of these license requirements and settlement agreements specify actions intended to reduce the effects of project operations on anadromous salmonids. A spring flow objective for the Mid-Columbia River was established in the 1998 FCRPS Supplemental Biological Opinion (NMFS 1998b). The flow objective established for steelhead migrating through the Columbia River above McNary Dam is 135 kcfs as measured at Priest Rapids Dam.

It is unclear at this time how the cumulative impacts of FERC-licensed and FCRPS hydropower project operations affect long-term fish health and survival. Given that this gap in our understanding constitutes a critical uncertainty, NMFS believes that additional actions should occur at each of the FERC-licensed and FCRPS hydropower projects in order to maximize the survival of all life stages of UCR spring chinook salmon and UCR steelhead in the action areas.

2. Habitat Effects on the Baseline

The quality and quantity of freshwater habitat in much of the Columbia River Basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydrosystem development, mining, and urbanization have radically changed the historical habitat conditions of the basin. With the exception of fall chinook, which generally spawn and rear in the mainstem rivers, salmon and steelhead spawning and rearing habitat is found in the tributaries to the Snake and Columbia Rivers. Anadromous fish typically spend from a few months to three years rearing in freshwater tributaries. Depending on the species, they spend from a few days to one or two years in the Columbia River estuary before migrating out to the

ocean and another one to four years in the ocean before returning as adults to spawn in their natal streams. Thirty-two subbasins provide spawning and rearing habitat.

Water quality in streams throughout the Columbia River Basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and animal grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally-approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Most of the water bodies in Oregon, Washington, and Idaho that are on the 303(d) list do not meet water quality standards for temperature. Temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that result in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and the emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers.

On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density, which can affect the timing and duration of runoff. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Many tributaries have been significantly depleted by water diversions. In 1993, fish and wildlife agency, Tribal, and conservation group experts estimated that 80 percent of 153 Oregon tributaries had low-flow problems (two-thirds caused at least in part by irrigation withdrawals) (OWRD 1993). The Northwest Power Planning Council (NWPPC) showed similar problems in many Idaho, Oregon, and Washington tributaries (NWPPC 1992).

Blockages that stop the downstream and upstream movement of fish exist at many agricultural, hydrosystem, municipal/industrial, and flood control dams and barriers. Highway culverts that are not designed for fish passage also block upstream migration. Migrating fish are diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and influence upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al*. 1993, Frissell 1993, Henjum *et al*. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence *et al*. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

Mainstem habitats of the Columbia, Snake, and Willamette Rivers have been affected by impoundments that have inundated large amounts of spawning and rearing habitat. Historically, fall chinook salmon spawned in the mainstem near The Dalles, Oregon, upstream to the Pend Oreille River in Washington and the Kootenai River in Idaho, in the Snake River downstream of Shoshone Falls, and upstream from the mouth of the Snake River to Grand Coulee Dam. Current mainstem production areas for fall chinook salmon are mostly confined to the Hanford Reach of the mid-Columbia River and to the Hells Canyon Reach of the Snake River, with minor spawning populations elsewhere in the mid-Columbia River, below the lower Snake River dams, and below Bonneville Dam. Hanford Reach is the only known mainstem spawning area for steelhead. Chum salmon habitat in the lower Columbia River may also have been inundated by Bonneville Reservoir. Mainstem habitat in the Columbia, Snake, and Willamette Rivers has been reduced, for the most part, to a single channel, floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars, and shallow areas. The mouth of the Columbia River was about four miles wide. Winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened and maintained, jetties and

pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels, marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. Sand deposition at river mouths has extended the Oregon coastline approximately four miles seaward and the Washington coastline approximately two miles seaward (Thomas 1981).

More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (Lower Columbia River Estuary Program [LCREP] 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

Studies begun in 1997 by the Oregon Cooperative Fish and Wildlife Research Unit, USGS, and the Columbia River Inter-Tribal Fish Commission (CRITFC) have shown that fish-eating birds that nest on islands in the Columbia River estuary (Caspian terns, double-crested cormorants, and glaucous-winged gulls) are significant avian predators of juvenile salmonids. Researchers estimated that the tern population on Rice Island (16,000 birds in 1997) consumed 6 to 25 million outmigrating smolts during 1997 (Roby *et al*.1998) and 7 to 15 million outmigrating smolts during 1998 (Collis *et al*. 1999). The observed levels of predation prompted the regional fish and wildlife managers to investigate the feasibility of management actions to reduce the impacts. Early management actions appear to have reduced predation rates; researchers estimate that terns consumed 7.3 million smolts during 1999 (Columbia Bird Research 2000). Rice Island is a dredged material disposal site in the Columbia River estuary, created by the Corps under its Columbia River Channel Operation and Maintenance Program.

The Basinwide Recovery Strategy (Federal Caucus 2000) outlines a broad range of current habitat programs. Because most of the basin's anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Examples of Federal actions likely to affect salmonids in the ESA-listed ESUs include authorized land management activities of the USFS and Bureau of Land Management (BLM). Federal actions, including the Corps' section 404 permitting activities under the Clean Water Act, the Corps' permitting activities under the River and Harbors Act, National Pollution Discharge Elimination System permits issued by EPA, highway projects authorized by the Federal Highway Administration, FERC licenses for non-Federal development and operation of hydropower, and Federal hatcheries may result in impacts to ESA-listed anadromous fish.

Several recovery efforts are underway that may slow or reverse the decline of salmon and steelhead populations. Notable efforts within the range of the UCR spring chinook salmon and UCR steelhead ESUs are the Northwest Forest Plan (NFP), PACFISH, Washington Wild Stock Restoration Initiative, and Washington Wild Salmonid Policy. PACFISH is an ecosystem-based

aquatic habitat and riparian-area management strategy that covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation. PACFISH provides objectives, standards, and guidelines that are applied to all Federal land management activities such as timber harvest, road construction, mining, grazing, and recreation. USFS and BLM implemented PACFISH beginning in 1995. Several components that are in addition to the PACFISH strategy are also being carried forward by NMFS, USFS, and BLM. These components include (but are not limited to) implementation monitoring and accountability, a system of watersheds that are prioritized for protection and restoration, improved and monitored grazing systems, road system evaluation and planning requirements, mapping and analysis of unroaded areas, multi-year restoration strategies, and batching and analyzing projects at the watershed scale.

The most significant element of the NFP for anadromous fish is its Aquatic Conservation Strategy (ACS), a regional-scale aquatic ecosystem conservation strategy that includes: (1) Special land allocations (such as key watersheds, riparian reserves, and late-successional reserves) to provide aquatic habitat refugia; (2) special requirements for project planning and design in the form of standards and guidelines; and (3) new watershed analysis, watershed restoration, and monitoring processes. These components collectively ensure that Federal land management actions achieve ACS objectives that strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and to restore currently degraded habitats.

The Basinwide Recovery Strategy also outlines a large number of non-Federal habitat programs. Because non-Federal habitat is managed predominantly for private rather than public purposes, however, expectations for non-Federal habitat are harder to assess. Degradation of habitat for ESA-listed fish from activities on non-Federal lands is likely to continue to some degree over the next ten years, although at a reduced rate due to state, tribal, and local recovery plans. Because a substantial portion of land in the ESA-listed salmonid ESUs is in state or private ownership, conservation measures on these lands will be key to protecting and recovering ESA-listed salmon and steelhead populations. NMFS recognizes that strong conservation benefits will accrue from specific components of many non-Federal conservation efforts, however, some of those conservation efforts are very recent and few address salmon conservation at a scale that is adequate to protect and conserve entire ESUs. NMFS will continue to encourage non-Federal landowners to assess the impacts of their actions on endangered and threatened salmonids. In particular, NMFS will encourage state and local governments to use their existing authorities and programs, and will encourage the formation of watershed partnerships to promote conservation in accordance with ecosystem principles.

3. Hatchery Effects on the Baseline

For more than 100 years, hatcheries in the Pacific Northwest have been used to replace natural production lost as a result of the construction of hydropower dams and other development, not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring chinook salmon, 80 percent of the summer chinook salmon, 50 percent of the fall chinook salmon, and 70 percent of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). While hatcheries certainly have

contributed greatly to the overall numbers of salmonids, only recently has the effect of hatcheries on native wild populations been demonstrated. In many cases, these effects have been substantial. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in wild coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995). Hatcheries have traditionally focused on providing fish for harvest, with less attention given to identifying and resolving factors causing declines of native runs.

NMFS has identified four primary categories of risk that hatcheries can pose on wild-run salmon and steelhead: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000a). Ecologically, hatchery fish can increase predation on, displace, and/or compete with wild fish. These effects are likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods during which they may prey on or compete with wild fish. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release diseases into streams via water effluents. Genetically, hatchery fish can affect the genetic variability of native fish via interbreeding, either intentionally or accidentally. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to and productive within the unique local habitats where the original native stock evolved.

In many areas, hatchery fish provide increased fishery opportunities. When wild fish mix with hatchery stock, fishing pressure can lead to overharvest of smaller or weaker wild stocks. Further, when migrating adult hatchery and wild fish mix on the spawning grounds, the health of the wild runs and the condition of the habitat's ability to support runs can be overestimated, because the hatchery fish mask surveyors' ability to discern actual wild run conditions.

The role of hatcheries in the future of Pacific Northwest salmon and steelhead is presently unclear; it will depend on the values people place on fish production and biological diversity. Clearly, conservation of biological diversity is gaining support, and the future role of hatcheries may shift toward judicial use of hatcheries to meet these goals rather than opposing them. One of the prime recommendations in the National Research Council's (NRC's) study of salmon in the Pacific Northwest is that hatchery use "should occur within the context of fully implemented adaptive-management programs that focus on watershed management, not just on the fish themselves" (NRC 1996). A recent review of this approach for the Columbia River Basin can be found in ISAB (1998).

4. Harvest Effects on the Baseline

The history of harvest of Columbia River Basin salmon and steelhead parallels that of the entire region. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1998).

Initially, the non-Indian fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and

freshwater harvest rates for Columbia River spring and summer chinook salmon exceeded 80 percent and sometimes 90 percent of the run, contributing to the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Until the spring of 2000, when a relatively large run of hatchery spring chinook salmon returned and provided a small commercial Tribal fishery, the last commercial season for spring chinook salmon had occurred in 1977. Present Columbia River harvest rates are very low compared with those from the late 1930s through the 1960s (NMFS 1991).

The summer chinook salmon run could not sustain the average harvest rate of 88 percent that was applied between 1938 to 1944 and produced lower returns between 1942 and 1949 (NMFS 1991). From 1945 through 1949, the Columbia River harvest rate on summer chinook salmon was reduced to about 47 percent, and subsequently, the run size increased. The construction of Grand Coulee Dam in 1941, with the resulting inundation of summer chinook salmon spawning areas, was a primary factor influencing this species' declining abundance. In the 1950s and 1960s, harvest rates further declined to about 20 percent (Raymond 1988). This species has not been the target of any commercial harvest since 1963.

Following the sharp declines in spring and summer chinook salmon in the late 1800s, fall chinook salmon became a more important component of the catch. Fall chinook salmon have provided the greatest contribution to Columbia River salmon catches in most years since 1890. Through the first part of this century, the commercial catch was usually canned for marketing. The peak year of commercial sales was 1911, when 49.5 million pounds of fall chinook salmon were landed. Columbia River chinook salmon catches were generally stable from the beginning of commercial exploitation until the late 1940s, when landings declined by about two-thirds to a level that remained stable from the 1950s through the mid-1980s (ODFW and WDFW 1998). Since 1938, total salmonid landings (all species) have ranged from a high of about 2,112,500 fish in 1941 to a low of about 68,000 fish in 1995 (Figure A.1 in ODFW and WDFW 1998).

Whereas freshwater fisheries in the basin were declining during the first half of this century, ocean fisheries were growing, particularly after World War II. This trend occurred up and down the West Coast as fisheries with new gear types leapfrogged over the others to gain first access to the migrating salmon runs. Large, mixed-stock fisheries in the ocean gradually supplanted the freshwater fisheries, which were increasingly restricted or eliminated to protect spawning escapements. By 1949, the only freshwater commercial gear types remaining were gill nets, dip nets, and hoop nets (ODFW and WDFW 1998). This leapfrogging by various fisheries and gear types resulted in conflicts about harvest allocation and the displacement of one fishery by another. Ocean trolling peaked in the 1950s; recreational fishing peaked in the 1970s. The ocean harvest has declined since the early 1980s as a result of declining fish populations and increased harvest restrictions (ODFW and WDFW 1998).

The construction of The Dalles Dam in 1957 had a major effect on Tribal fisheries. The Dalles Reservoir flooded Celilo Falls and inundated the site of a major Indian fishery that had existed for millennia. Commercial Indian landings at Celilo Falls from 1938 through 1956 ranged from 0.8 to 3.5 million pounds annually, based primarily on dip netting (ODFW and WDFW 1998). With the elimination of Celilo Falls, salmon harvest in the area declined dramatically. In 1957,

in a joint action, the states of Oregon and Washington closed the Tribal fishery above Bonneville Dam to commercial harvesters. Treaty Indian fisheries that continued during 1957 through 1968 were conducted under Tribal ordinances. In 1968, with the Supreme Court opinion on the appeal of the *Puyallup v. Washington* case, the states reopened the area to commercial fishing by treaty Indians (ODFW and WDFW 1998). For the next 6 years, until 1974, only a limited Tribal harvest occurred above Bonneville Dam. By then, the Tribal fishery had developed an alternative method of setting gill nets that was suitable for catching salmon in the reservoirs (ODFW and WDFW 1998).

The capacity of salmonids to produce more adults than are needed for spawning offers the potential for sustainable harvest of naturally-produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events. However, as long as the two management requirements are met, fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management.

5. Natural Conditions

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. Recent evidence suggests that marine survival of salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Cramer *et al*. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. For example, large-scale climatic regimes, such as El Niño, appear to affect changes in ocean productivity. During the first part of the 1990s much of the Pacific Coast was subject to a series of very dry years. In more recent years, severe flooding has adversely affected some stocks, and the low return of Lewis River bright fall chinook salmon in 1999 is attributed to flood events during 1995 and 1996. Thus the survival and recovery of these species will depend on their ability to persist through periods of low natural survival rates.

A key factor affecting many West Coast stocks has been the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven

largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999b).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration. The available water in the upper Columbia River Basin is 50-60% of normal and will result in some of the lowest flow conditions on record. These conditions will have the greatest effect on upriver stocks such as the ones being discussed in this opinion. The juveniles that must pass down river during the 2001 spring and summer out-migration will likely be affected and this, in turn, will affect adult returns primarily in 2003 and 2004, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NMFS is carefully monitoring the situation and will take the drought condition into account in any management decision, including amending take authorizations and other permit conditions.

6. Scientific Research

UCR spring chinook salmon and UCR steelhead, like other ESA-listed fish, are the subject of scientific research and monitoring activities. Most biological opinions that NMFS issues recommend specific monitoring, evaluation, and research projects to gather information to aid in the survival of ESA-listed fish. In addition, NMFS has issued numerous research permits authorizing takes of ESA-listed fish over the last few years. Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes relative to the total number of fish has increased. The effect of these activities is difficult to assess, nevertheless, the potential benefits to ESA-listed salmon and steelhead from the scientific information is likely to be greater than the potential risk to the species due to those efforts. Potential benefits include enhancing the scientific knowledge base for the species and answering questions or contributing information toward resolving difficult resource issues. The information gained during research and monitoring activities will assist resource managers in making more informed decisions regarding recovery measures. Moreover, scientific research and monitoring efforts are not considered to be a factor contributing to the decline of UCR spring chinook salmon and UCR steelhead populations, and the information derived from the research activities is essential to survival and recovery efforts.

To reduce adverse effects from research activities on the species, NMFS imposes conditions in its permits so that Permit Holders conduct their activities in such a way as to minimize adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Also, researchers are encouraged to use non-listed fish species and/or ESA-listed hatchery fish, instead of ESA-listed, naturally-produced fish, for scientific research purposes when possible. In addition, researchers are required to share sample fish, as well as the results of the scientific research, with other researchers and comanagers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research underway to prevent duplication of effort.

In general, for projects that require a section 10(a)(1)(A) permit, applicants will provide NMFS with high take estimates to compensate for potential inseason changes to research protocols, accidental catastrophic events, and the annual variability in ESA-listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. Therefore, the actual take in a given year for most research projects, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS consultation on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species to result from the conduct of scientific research activities are usually less than the effects analyzed in a typical consultation.

To demonstrate the difference between authorized takes and actual takes, the take levels that are addressed in the previous (and still valid) consultations on the issuance of section 10(a)(1)(A) research permits that involve takes of UCR spring chinook salmon and UCR steelhead (the November 12, 1999 consultation and the April 10, 1998 consultation respectively) can be compared with the actual takes that occurred in a year in which the takes are permitted. The following tables provide a comparison of the total authorized take of UCR spring chinook salmon (Table 1) and UCR steelhead (Table 2) under NMFS' section 10(a)(1)(A) research permits (that were previously issued) with the total actual take of those species, as reported to NMFS in post-season annual reports, for the 1999 research season:

Table 1. 1999 Authorized Take of ESA-listed Upper Columbia River Chinook Salmon and Steelhead for Section 10(a)(1)(A) Scientific Research Permits

			Upper Columbia River Spring Chinook Salmon						Upper Columbia River Steelhead					
			Adult		Juvenile				Adult		Juvenile			
Permit No.	Latest Action	Permit Holder	HANDLE	MORT	HANDLE		MORTALITY		HANDLE	MORT	HANDLE		MORTALITY	
					Hatchery	Natural	Hatchery	Natural			Hatchery	Natural	Hatchery	Natural
900	mod 7	NMFS/NWFSC/FED			10216	3957	203	79			62134	6344	310	32
946	mod 6	NMFS/NWFSC/FED			11	4	57	20			66	6	14	8
948	mod 3	N. Wasco Co. PUD			12	1	0	0			15	5	1	0
994	mod 4	ICFWRU							16	0				
1036	mod 2	USGS			14	50	0	1			76	56	2	1
1102	mod 1	WDFW							546	1				
1114	mod 2	WDFW			13209	3708	396	111	80	0	26000	9000	520	180
1115	amd	Chelan PUD	5	0	9782	968	196	19	505	0	130707	1143	2614	23
1116	mod 2	Douglas PUD									80557	358	1873	16
1119	amd	USUSFWS			150	450	5	14	50	1	166	34	8	2
1130	mod 1	USGS			156	74	5	2			504	0	25	0
1134	mod 1	CRITFC	107	1	213	135	2	2	20	0	1739	261	10	2
1136	mod 1	OCFWRU			158	118	38	39			414	67	20	2
1140	mod 1	NMFS/NWFSC/ECD			7	8	0	0			10	1	1	0
1141	amd	Grant PUD	10	0	921	689	18	14	25	0	10708	7042	1148	740
1193	mod 1	FPC			14100	5350	282	107			30100	9600	314	192
1194	permit	NMFS/NWFSC/FED							14	1				
1212	amd	NMFS/NWFSC/FED			2597	974	26	10			1731	216	18	3
1213	mod 1	NMFS/NWFSC/FED			19985	7834	413	160	18	0	79629	8127	1218	123
1218	permit	WDFW			0	1	0	0	100	0	0	100	0	105
		Totals	122	1	71531	24321	1641	578	1374	3	424556	42360	8096	1429
		Handling by Species	122		71531	24321			1374		424556	42360		
		Mortalities by Species		1			1641	578		3			8096	1429

Table 2. 1999 Reported Take of ESA-listed Upper Columbia River Chinook Salmon and Steelhead for Section 10(a)(1)(A) Scientific Research Permits

			Upper Columbia River Spring Chinook Salmon						Upper Columbia River Steelhead					
			Adult		Juvenile				Adult		Juvenile			
Permit			HANDLE	MORT	HANDLE		MORTALITY		HANDLE	MORT	HANDLE		MORTALITY	
No.	Latest Action	Permit Holder			Hatchery	Natural	Hatchery	Natural			Hatchery	Natural	Hatchery	Natural
900	mod 7	NMFS/NWFSC/FED			12111	4691	93	36			24884	2541	1	0
946	mod 6	NMFS/NWFSC/FED			2	1	2	1			9	1	5	1
948	mod 3	N. Wasco Co. PUD			2	1	0	0			19	1	0	0
994	mod 4	ICFWRU							0	0				
1036	mod 2	USGS			10	4	0	0			1	0	0	0
1102	mod 1	WDFW							223	0				
1114	mod 2	WDFW			3359	1609	133	51	61	2	19250	5857	72	28
1115	amd	Chelan PUD	0	0	8279	954	21	0	97	0	97418	1263	384	0
1116	mod 2	Douglas PUD									74454	0	217	1
1119	amd	USFWS			0	0	0	0	32	0	46	0	0	0
1130	mod 1	USGS			151	0	4	0			372	0	18	0
1134	mod 1	CRITFC	13	0	54	28	0	0	0	0	90	5	0	0
1136	mod 1	OCFWRU			26	70	2	5			56	53	1	2
1140	mod 1	NMFS/NWFSC/ECD			3	1	0	0			10	0	0	0
1141	amd	Grant PUD	0	0	894	96	0	0	0	0	794	131	40	0
1193	mod 1	FPC			5526	2140	38	15			10027	2088	17	3
1194	permit	NMFS/NWFSC/FED							2	0				
1212	amd	NMFS/NWFSC/FED			8	0	0	0			60	1	1	0
1213	mod 1	NMFS/NWFSC/FED			7962	5756	56	25	0	0	8152	1544	48	2
1218	permit	WDFW			0	0	0	0	0	0	0	0	0	0
		Totals	13	0	38387	10660	349	133	415	2	235642	13485	804	37
		Handling by Species	13		38387	10660			415		235642	13485		
		Mortalities by Species		0			349	133		2			804	37

V. Analysis of the Effects of the Proposed Actions

A. Effects on Critical Habitat

As noted above, critical habitat has been designated for both the UCR spring chinook salmon and the UCR steelhead. The essential features of the critical habitat are set out in the Environmental Baseline section of this consultation.

The types of activities likely to impact habitat are fully described in the description of the actions in section II of this consultation. In general, researchers will conduct streamside surveys by walking along banks, instream snorkeling surveys, and in one case operate a smolt trap. There will be minimal disturbance to vegetation, and no harm to spawning or rearing habitat, or to water quantity and water quality. Many of these activities will be of short duration, during limited field opportunities linked to migration patterns of the targeted populations. Thus there will be minimal effects on the critical habitat of these species from the actions discussed in this opinion, certainly not enough to contribute to a decline in the values of the habitat.

B. Effects on UCR Spring Chinook Salmon and UCR Steelhead

The purpose of this section is to identify the effects on endangered UCR spring chinook salmon and endangered UCR steelhead due to NMFS' issuance of scientific research permits. For some of the research activities, the takes of ESA-listed salmonids occur on the mainstem rivers and/or at the hydropower dams on the mainstem rivers. Researchers are not able to distinguish between the different populations when working outside of the tributary watersheds from which the fish originate. As such, for research that occurs on the mainstem rivers, the analyses are not sensitive enough to evaluate the effects of proposed research activities on the ESA-listed species at the population level because of insufficient information. To the extent currently possible, this analysis will include analyses of effects at the population level. Where information on ESA-listed chinook salmon and steelhead at the population level does not exist, this analysis assumes that the status of each affected population is the same as the respective ESU as a whole. The general effects of scientific research activities, including actions that will mitigate impacts, are discussed first, followed by permit specific effects.

Harassment is a primary form of take associated with the proposed activities on the ESA-listed chinook salmon and steelhead, and includes stress and other sub-lethal effects from observation and capture/handling. The ESA does not define harassment nor has NMFS defined this term through regulation pursuant to the ESA. However, USFWS defines "harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

For some studies, ESA-listed fish will be observed in-water (i.e. snorkel surveys). Direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating the relative abundance. Typically, a cautious observer is effective in obtaining data without disrupting the normal behavior of a fish. Fry and juveniles frightened by

the water turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize disturbance to fish by moving through streams slowly thus allowing ample time for fish to reach escape cover. During some research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur. Based on prior research experience, the proposed observation/harassment of ESA-listed fish should not have long-term, adverse effects on any of the populations or species as a whole.

Techniques such as electrofishing, the use of seines or traps, PIT-tagging, fin-clipping, and the use of radiotransmitters are common to many scientific research efforts on the ESA-listed species. All sampling, handling, and tagging procedures carry an inherent potential for causing stress, disease transmission, injury, or death. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed juvenile salmonids expected from the capture and handling procedures for the actions in this opinion is not likely to exceed 5 percent of the fish subjected to handling, and in most cases, unintentional mortality of ESA-listed juvenile fish will not exceed 3 percent. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed adult salmonids expected from the capture and handling procedures is not likely to exceed 1 percent of the fish subjected to handling. ESA-listed adult and juvenile fish indirect mortalities may be retained as reference specimens or used for analytical research purposes.

The effects of electrofishing on ESA-listed anadromous salmonids within the action area would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding on captured fish in aerated tanks, and the effects of handling associated with transfer of the fish back to the river. It has long been recognized that overexposure of fish to a strong electric field can cause injury and death. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise and experience of the technician. The effects of electrofishing on adults can be severe. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing caused a 50 percent mortality level in adult rainbow trout. Habera *et al*. (1996) reported overall mortality rates of 20 percent for rainbow trout less than 100 mm in length and 6 percent for those over 100 mm using a three pass depletion method. Habera *et al*. also reported an overall injury rate of 6 percent. The long-term effects on both juveniles and adult salmonids are not well understood, but it is assumed that most impacts from electrofishing occur at the time of sampling.

Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey *et al.* 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury is substantially lower than in large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey *et al.* 1996, Thompson *et al.* 1997). The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and

Carothers 1988, McMichael 1993, Dalbey *et al.* 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency (≤30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey *et al.* 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms ((Fredenberg 1992, Taube 1992, McMichael 1993, Sharber *et al.* 1994, Dalbey *et al.* 1996). Only a few recent studies have examined the long-term effects of electrofishing on survival and growth of salmonids (Ainslie *et al.* 1998, Dalbey *et al.* 1996, Taube 1992). These studies indicate that although relatively large percentages of the fish suffered spinal injury, long-term mortality was very low. However, severely injured fish grew at slower rates or showed no growth compared to control or minimally damaged fish (Dalbey *et al.* 1996).

For electroshocking surveys, NMFS' electrofishing guidelines (NMFS 2000c) will be followed. This will include training field crews in observing animals for signs of stress and how to adjust electrofishers to minimize stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish prior to the application of an electrical current. Electrofishing is not done in the vicinity of redds or where fish are visually observed. All people operating electroshocking equipment are trained by qualified personnel to be familiar with equipment handling, settings, care, and safety. Operators work in pairs to increase visual detection of fish and fish identification with minimal or no netting. Working in pairs also allows the netter to intercept and net the fish before it is attracted to water with higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels. At the start of every electrofishing session, water conductivity will be tested, and settings will be set at minimum rates. Settings will be kept below levels which cause immobilization. Due to the low settings used, shocked fish are normally instantaneously revived. Fish requiring reviving will receive immediate, adequate care.

The capture and handling process is likely to cause some stress on ESA-listed fish. Typically, fish recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperatures, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Also, stress can occur if there are more than a few degrees difference in water temperature between the stream/river and the holding tank. Fish that are transferred to holding tanks could experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also cause injuries and mortalities if the traps are not monitored and cleared on a regular basis.

Concerns have been raised with respect to disease transmission during PIT-tagging operations. The use of one needle to tag multiple fish has the potential to transmit bacterial kidney disease to the fish that are tagged. To reduce potential risks to ESA-listed fish, all permit holders will be required to use state-of-the-art handling and tagging techniques. To minimize the lateral transfer of pathogens, a sterilized needle is used for each individual injection when PIT-tagging ESA-listed fish. All tagging procedures will require the fish to be anesthetized. Because temperature, turbidity, fish condition, and other factors can alter a fish's reaction to anesthetics, the

concentration of an anesthetic will be adjusted for the ambient environmental conditions based on the manufacturers specifications to achieve proper sedation and minimize the risk of harming fish. The fish subjected to anesthetics will be allowed to fully recover before being released.

The potential for unexpected injuries or mortalities to ESA-listed fish will be mitigated in a number of ways. Wet hands and keeping fish submersed while measuring will minimize scale and slime removal. Study protocols would include only handling fish during appropriate water temperatures to avoid adding any additional stress and ensuring revival prior to release. Traps are proposed to be checked each morning or more frequently as necessitated by increased water flows or debris movement. Traps would not be fished during time periods when they cannot be adequately checked and maintained. Checking traps during the morning would ensure handling fish during the coolest water temperatures to reduce stress and potential mortality. Fish are transferred from the trap to recovery buckets by the use of dip nets or sanctuary nets. The use of nets avoids human handling and reduces the potential for descaling or other netting injuries and potential post-handling mortality. Appropriate anesthetics will be used to calm fish subjected to handling. Dosages will vary by body size but would be kept at minimum levels. After the collection of biological data, captured fish will be allowed to fully recover before being released back into the stream and will be released only in slow water areas.

Before NMFS receives permit applications, most proposed research projects are evaluated by regional scientific and technical committees that have the responsibility to assign funding to scientific research identified as being important for advancing the survival and recovery of ESA-listed anadromous fish populations. The committees consist of representatives from all of the major Federal, state, and tribal agencies involved in anadromous fish research and/or recovery as well as funding agencies such as BPA and the Northwest Power Planning Council. Prior to the receipt of a complete permit application by NMFS, all research proposals are subjected to various levels of scrutiny by the comanagers in the Region, including professional scientists and technical specialists at NWFSC and the appropriate technical division at NMFS in Portland (Protected Resources Division, Hydropower Branch, Habitat Conservation Division, or the Sustainable Fisheries Division), so as to identify any techniques or research protocols that could result in excessive impacts to ESA-listed species, or which could otherwise be considered controversial. After the controversial aspects of research proposals and/or protocols are identified, they are either discarded or revised to avoid the potential for excessive impacts.

After a complete permit application is received by NMFS, each research study plan and permit application is provided to professional resource managers and scientific experts (including NMFS' Northwest Fisheries Science Center), as well as members of the general public, for review and evaluation during a 30-day comment period. The 30-day comment period is initiated with the publication of a Notice of Receipt in the *Federal Register*. Any comments received by NMFS during the 30-day comment period are then provided to the Applicant for responses. NMFS' decision to issue a permit depends in part on the comments received during the 30-day comment period and the adequacy of the Applicant's responses to the comments. All comments and responses to comments are found in the administrative record for each permit action, which are on file with NMFS' Protected Resources Division in Portland, Oregon.

Under section 10(d) of the ESA, NMFS is prohibited from issuing a section 10(a)(1)(A) permit unless NMFS finds that the permit (1) was applied for in good faith; (2) if granted and exercised, will not operate to the disadvantage of the endangered and/or threatened species that is/are the subject of the permit; and (3) is consistent with the purposes and policy of section 2 of the ESA. In addition, NMFS does not issue a section 10(a)(1)(A) permit unless the proposed activities are likely to result in a net benefit to the ESA-listed species that is/are the subject of the permit. Benefits to ESA-listed species accrue from the acquisition of scientific information. For more than a decade, research and monitoring activities conducted with anadromous salmonids in the Pacific Northwest have provided resource managers with a wealth of important and useful information on anadromous fish populations. For example, juvenile fish trapping efforts have enabled the production of population inventories, PIT-tagging efforts have increased the knowledge of anadromous fish migration timing and survival, and fish passage studies have provided an enhanced understanding of fish behavior and survival when moving past dams and through reservoirs. By issuing section 10(a)(1)(A) scientific research permits, NMFS will cause information to be acquired that will enhance the ability of resource managers to make more effective and responsible decisions to sustain anadromous salmonid populations that are at risk of extinction, to mitigate impacts to endangered and threatened chinook salmon and steelhead, and to implement recovery efforts. The resulting data will improve the knowledge of the respective species' life history, specific biological requirements, genetic make-up, migration timing, responses to anthropogenic impacts, and survival in the river system.

Detailed analyses of the effects of each individual permit action follow:

C. Modifications to Existing Permits

1. Permit 1114 Modification 3

The proposed modification to WDFW's permit would authorize the capture, handling, tagging, transportation, and release of adult, endangered, UCR steelhead. The proposed annual take is enumerated below:

Type of Take	UCR Steelhead Adults
Capture, tag/mark, release	400
Total non-lethal take	**400**
Direct Mortality	0
Indirect Mortality	4
Total lethal take	**4**

The takes of ESA-listed steelhead associated with WDFW's scientific research activities will occur at Priest Rapids Dam on the mainstem Columbia River. The majority of the ESA-listed adult fish to be tagged with radiotransmitters will be artificially-propagated steelhead from WDFW's steelhead supplementation program produced from the Wells Hatchery complex in the UCR Basin (WDFW estimates up to 84 percent of the fish to be tagged, or up to 336, will be of hatchery origin). For the naturally-produced adult steelhead proposed to be tagged, researchers will not be able to distinguish between the different populations when working at Priest Rapids

Dam since the dam is located outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the effects due to proposed research activities on ESA-listed, naturally-produced steelhead at the population level. The analysis for this particular permit action assumes that the status of each affected population is the same as the ESU as a whole.

The potential risks to the ESA-listed adult steelhead proposed to be taken include injury or death due to the gastric implantation of radio-tags, handling stress related to transfer, and reduced spawning success or failure to spawn. Based upon WDFW's experience with this type of research, a maximum of 4 out of 400 adult steelhead may be directly killed annually due to radio-tagging, recovery, and release activities (WDFW 1999b). In a three-year radio-tagging study conducted by scientists of the University of Idaho at Bonneville Dam, a total of 1,745 adult summer steelhead were radio-tagged while only one steelhead (0.06 percent) was directly killed as a result of the radio-tagging efforts (WDFW 1999b). Reduced spawning success or failure to spawn as a result of WDFW's research activity is unknown at this time but will be monitored by WDFW. Currently, WDFW is authorized to collect up to 648 (420 at Wells Dam and 228 from the Wenatchee River) adult UCR steelhead for the hatchery broodstock program and 246-735 adult UCR steelhead each year for the stock assessment sampling at Priest Rapids Dam (under a separate take authorization). For typical run sizes, the total number of adult steelhead collected for broodstock is less than 10 percent of the UCR steelhead adult escapement to Priest Rapids Dam each year. However, annual broodstock collection will probably be less than 10 percent of the total escapement because of passage loss, natural mortality, and delayed tributary entry (into the Wenatchee River). WDFW will monitor the spawning success of any radio-tagged adults collected for broodstock in the hatchery environment (under a separate take authorization) as well as the spawning success of the radio-tagged adults allowed to reproduce in the wild. Biologists with Grant County PUD, Chelan County PUD, and Douglas County PUD will cooperate with WDFW in tracking the radio-tagged adult steelhead as they migrate upstream.

WDFW will take the following measures to minimize risks to ESA-listed UCR steelhead adults: (1) Fish density will be monitored in the brail and no more than six fish will be in the brail at any one time; (2) adults will be transferred using fish nets and/or "wet boots "to reduce handling stress; (3) fish will be anesthetized using MS222 and the anesthetic bath will be changed at least once a day; (4) adults will be allowed to recover in tanks with circulating freshwater; (5) temperature constraints have been developed to reduce additional stress (for example, the trap will not be operated at water temperatures $\geq 70^{\circ}$ F); (6) no more than eight radio-tagged fish will be transported in trucks (furnished with freshwater circulation, an oxygenation system, and adult release gate) at one time to the release location; and (7) trap operations will be discontinued if significant numbers of non-listed fish are being delayed in the fishway (WDFW 1999b).

The radio-tagging study will provide valuable information on the benefits and potential risks of WDFW's hatchery program on the wild steelhead population. Monitoring and evaluating the productivity of hatchery fish spawning in the wild and the life history traits of both the hatchery and wild steelhead used by WDFW for broodstock is important during the transition to locally-adapted broodstocks in the UCR Basin. WDFW has adequate measures in place to minimize the

effects of the non-lethal take on the species, and very few deaths, proportionate to the number handled, are expected.

2. Permit 1115 Modification 3

The proposed modification to the Chelan County PUD's permit would authorize take associated with observation/harassment, snorkel surveys and spawning ground surveys. The modification would also authorize the collection of tissues and/or scales from ESA-listed fish carcasses; take associated with a salvage operation at Rocky Reach Dam; and authorize the capture, handling and release, or the capture, handling, tagging and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. The proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Collect for transport	50	0	0	50
Capture, handle, release	0	27,995	5,505	33,500
Capture, tag/mark, release	0	9,223	1,527	10,750
Total non-lethal take	**50**	**37,218**	**7,032**	**44,300**
Direct Mortality	0	0	0	0
Indirect Mortality	0	744	141	885
Total lethal take	**0**	**744**	**141**	**885**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	21,293	5,450	26,743
Capture, tag/mark, release	0	1,907	1,907
Total non-lethal take	**21,293**	**7,357**	**28,650**
Direct Mortality	0	0	0
Indirect Mortality	426	147	573
Total lethal take	**426**	**147**	**573**

Chelan County PUD's proposed snorkel surveys, spawning ground surveys, and carcass surveys involve the temporary harassment of ESA-listed salmonids using passive observation techniques. The effects of harassment on listed fish, and the ways to minimize the effects were discussed above in the general effects portion of this section. Researchers will use those minimization techniques. Tissues and scales will be acquired from fish carcasses and retained for archival and/or analysis or provided to WDFW for archival and/or analysis.

Chelan County PUD's proposed salvage operation at Rocky Reach Dam involves the collection, transport, and release of adult, endangered, UCR spring chinook salmon (both naturally-produced and artificially-propagated) that fall back after passing Rocky Reach Dam and are intercepted at the diversion screens in the turbine units at the dam. The adult chinook salmon then enter the juvenile bypass system and end up at the juvenile evaluation facility. There, the adult chinook salmon are immediately removed from the raceway using sanctuary nets and carefully returned to the Columbia River. Chelan County PUD expects that up to 50 adult, endangered, UCR spring chinook salmon may fall back at the dam annually and will require assistance. Whereas the majority of these fish are likely to be from the tributaries upstream of Rocky Reach Dam (Entiat and Methow River systems), it is possible that some of the migrating adult chinook salmon to be taken are trying to return to the Wenatchee River system, the confluence of which is downstream of Rocky Reach Dam. As such, this analysis is not sensitive enough to evaluate the effects due to the proposed activity on ESA-listed spring chinook salmon at the population level because of insufficient information. The analysis for this particular activity assumes that the status of each affected population is the same as the ESU as a whole. No mortalities are expected to occur. Without assistance, these trapped adult chinook salmon would not be able to return to the river and would eventually die.

The proposed non-lethal take of ESA-listed UCR spring chinook salmon juveniles associated with Studies 1, 2, 4, and 5 will occur at Rocky Reach Dam on the mainstem Columbia River. The populations of UCR spring chinook salmon that will be affected by the proposed research at Rocky Reach Dam are those populations that originate upstream of the dam. Such populations include those originating from the Methow and Entiat Rivers. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 25,650 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 424,000 (unpublished data, WDFW). Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Entiat River in 2001 will be 19,238 (unpublished data, Chelan County PUD); no ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles will be produced from the Entiat River in 2001 (unpublished information, WDFW). Since the juvenile fish to be used for research purposes are randomly selected by Chelan County PUD researchers at Rocky Reach Dam, the probability that a sample fish is of Methow River origin versus Entiat River origin is approximately 4:3 for naturally-produced fish (25,650/19,238); all artificially-propagated spring chinook salmon juveniles to be taken at Rocky Reach Dam will be from the Methow River. Therefore, the proposed research sampling at Rocky Reach Dam could have a somewhat greater impact on the naturally-produced spring chinook salmon originating from the Entiat River (compared with those from the Methow River). However, in the mainstem Columbia River, where the survival rate is likely the same for all juvenile fish regardless of origin, the relative impact due to the proposed research activities is likely to be the same for all ESA-listed, naturally-produced, spring chinook salmon populations.

The proposed lethal take of UCR spring chinook salmon juveniles due to the proposed research activities is not likely to result in a substantially greater impact to any one population over

another. The research is not intended to emphasize one population type over another. The naturally-produced spring chinook salmon juveniles produced from both the Methow and Entiat River populations appear to have approximately an equal chance of being taken at Rocky Reach Dam by Chelan County PUD based on the proposed sampling effort; all artificially-propagated spring chinook salmon juveniles proposed to be taken at Rocky Reach Dam will be from the Methow River. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach Rocky Reach Dam in 2001 will be 42,323 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Rocky Reach Dam in 2001 will be 248,766 (Table 3, Appendix 4). If the estimated production for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 141 natural-origin UCR spring chinook salmon smolts and the loss of up to 744 hatchery-produced UCR spring chinook salmon smolts annually (2 percent indirect mortality level), are very low in proportion to the population's overall sizes, and the population can withstand this impact.

The proposed non-lethal take of ESA-listed UCR steelhead juveniles associated with Studies 1, 2, 4, and 5 will occur at Rocky Reach Dam on the mainstem Columbia River. The populations of UCR steelhead that will be affected by the proposed research are those that originate upstream of the dam. Such populations include those originating from the Okanogan, Methow, and Entiat Rivers, although WDF et al. (1993) suggested that the original Okanogan River steelhead stock may be extinct except for resident morphs (rainbow trout) in Salmon and Omak Creeks. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Methow River in 2001 will be 158,301 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Methow River in 2001 will be 520,318 (unpublished data, WDFW). Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Entiat River in 2001 will be 78,100 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Entiat River in 2001 will be 93,176 (unpublished data, WDFW). Since the juvenile fish to be used for research purposes are randomly selected by Chelan County PUD researchers, the probability that a sample fish is of Methow River origin versus Entiat River origin is approximately 2:1 for naturally-produced fish (158,301/78,100) and approximately 5.6:1 for artificially-propagated fish (520,318/93,176). Therefore, the research could have a greater impact on the naturally-produced and artificially-propagated steelhead originating from the Entiat River (compared with those from the Methow River). However, in the mainstem Columbia River, where the survival rate is likely the same for all juvenile fish regardless of origin, the relative impact due to the proposed research is likely to be the same for all ESA-listed steelhead populations.

The proposed lethal take of UCR steelhead juveniles due to the proposed research is not likely to result in a substantially greater impact to any one population over another. Based on the expected juvenile steelhead production from the Methow and Entiat Rivers in 2001, of the 147 naturally-produced steelhead mortalities expected to occur as a result of the research, approximately 98 would be juvenile steelhead from the Methow River and approximately 49

would be juvenile steelhead from the of Entiat River. Of the 426 artificially-propagated steelhead mortalities expected to occur as a result of the research, approximately 361 would be juvenile steelhead from the Methow River and approximately 65 would be juvenile steelhead from the Entiat River. However, the research is not intended to emphasize one population type over another. According to NMFS' juvenile steelhead outmigration estimates for 2001 (Schiewe 2001), the total number of naturally-produced, UCR steelhead juveniles expected to reach Rocky Reach Dam in 2001 will be 220,571 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Rocky Reach Dam in 2001 will be 561,462 (Table 4, Appendix 4). If the estimated production of steelhead for the 2001 outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 147 natural-origin UCR steelhead smolts and the loss of up to 426 hatchery-produced UCR steelhead smolts annually (2 percent indirect mortality level), from the UCR steelhead populations that originate from the Methow and Entiat Rivers are very low in proportion to the affected population's respective sizes and will not affect viability.

To minimize lethal take, all fish will be held in flowing river water. Anesthetizing and tagging protocols established by NMFS will be used. To prevent bacterial infection and the transmission of disease, Chelan County PUD personnel will sterilize all equipment as necessary and follow established protocols to minimize contact with contaminants (Chelan County PUD 1998).

3. Permit 1119 Modification 2

The proposed modification of USFWS's permit would authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. The proposed annual take is enumerated below:

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	334	266	600
Total non-lethal take	**334**	**266**	**600**
Direct Mortality	0	0	0
Indirect Mortality	7	5	12
Total lethal take	**7**	**5**	**12**

The proposed non-lethal and lethal takes of juvenile, endangered, UCR steelhead will occur in the Entiat River Basin. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Entiat River in 2001 will be 78,100 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Entiat River in 2001 will be 93,176 (unpublished data, WDFW). NMFS believes that the annual loss of up to 5 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 7 juvenile, endangered, artificially-propagated, UCR steelhead from the Entiat River population (2 percent indirect mortality level), will have very little impacts on these populations.

USFWS proposes to use the following measures to minimize and mitigate take: (1) The annual sampling effort will be in proportion to the relative annual production of ESA-listed juvenile fish; (2) to avoid adverse effects to ESA-listed steelhead, USFWS researchers will reduce their sampling effort during years when juvenile fish production is expected to be low; (3) all fish sampled will be anesthetized and monitored to prevent overexposure; (4) traps capturing smolts have been recently modified to deflect most debris which is a major cause of injury to trapped smolts; (5) all steelhead will be held in flowing river water that is monitored for temperature and oxygen; and (6) prior to release, the water at the release site and holding containers will be compared to minimize the transition stress of captured fish (USUSFWS 1998). NMFS considers these to be adequate measures to minimize the impacts of the proposed activities.

4. Permit 1141 Modification 2

The proposed modification to the Grant County PUD's permit would: (1) authorize the collection and transportation of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with fish salvage operations at Wanapum and Priest Rapids Dams; and (2) authorize the capture, handling, and release or the capture, handling, tagging, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. Grant County PUD's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Species Total
Collect for transport	5	333,000	37,000	370,005
Capture, handle, release	0	207,000	23,000	230,000
Total non-lethal take	**5**	**540,000**	**60,000**	**600,005**
Direct Mortality	0	0	0	0
Indirect Mortality	0	5,400	600	6,000
Total lethal take	**0**	**5,400**	**600**	**6,000**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Species Total
Collect for transport	91,000	39,000	130,000
Capture, handle, release	43,100	14,000	57,100
Capture, tag/mark, release	740	0	740
Total non-lethal take	**134,840**	**53,000**	**187,840**
Direct Mortality	0	0	0
Indirect Mortality	1,372	530	1,902

Total lethal take	**1,372**	**530**	**1,902**

Grant County PUD's proposed takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon; and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead will occur at Wanapum and Priest Rapids Dams on the mainstem Columbia River. All of the ESA-listed adult and juvenile salmonids proposed to be taken by Grant County PUD originate upstream of the dams. Grant County PUD's personnel are not able to distinguish between the different populations of UCR spring chinook salmon and UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted, this analysis is not sensitive enough to evaluate the effects due to the proposed action on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

The annual non-lethal take of UCR spring chinook salmon adults and juveniles and the annual lethal take of UCR spring chinook salmon juveniles due to Grant County PUD's proposed salvage and monitoring activities are not likely to result in a substantially greater impact to any one population over another since the probability of being taken is equivalent for all population types at Wanapum and Priest Rapids Dams. Also, the proposed activities are not intended to emphasize one population type over another. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach Wanapum Dam in 2001 will be 68,909 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Wanapum Dam in 2001 will be 261,800 (Table 3, Appendix 4). If the estimated production for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 600 natural-origin UCR spring chinook salmon smolts annually and the loss of up to 5,400 hatchery-produced UCR spring chinook salmon smolts annually (1 percent indirect mortality level) will not impact the viability of the populations that originate upstream of Wanapum Dam. In fact, Grant County PUD's salvage operations are intended to enhance the survival of endangered UCR spring chinook salmon over the alternative of a more substantial mortality rate if the fish are not assisted.

The annual non-lethal and lethal takes of UCR steelhead juveniles due to Grant County PUD's proposed salvage and monitoring activities are not likely to result in a substantially greater impact to any one population over another since the probability of being taken is equivalent for all population types at Wanapum and Priest Rapids Dams. Also, the proposed activities are not intended to emphasize one population type over another. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced, UCR steelhead juveniles expected to reach Wanapum Dam in 2001 will be 201,870 and the total number of artificially-propagated, UCR steelhead juveniles expected to reach Wanapum Dam in 2001 will be 593,000 (Table 4,

Appendix 4). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 530 natural-origin UCR steelhead smolts and the loss of up to 1,325 hatchery-produced UCR steelhead smolts annually (1 percent indirect mortality level), will not impact the viability of the UCR steelhead populations that originate upstream of Wanapum Dam. In fact, Grant County PUD's salvage operations are intended to enhance the survival of endangered UCR steelhead over the alternative of a more substantial mortality rate if the fish are not assisted.

The annual non-lethal and lethal takes of UCR steelhead juveniles due to Grant County PUD's scientific research activities are not likely to result in a substantially greater impact to any one population over another since the probability of being subjected to collection for research purposes is equivalent for all population types at Wanapum and Priest Rapids Dams. Also, the research activities are not intended to emphasize one population type over another. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of artificially-propagated, UCR steelhead juveniles expected to reach Wanapum Dam in 2001 will be 593,000 (Table 4, Appendix 4). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS believes that the loss of an additional 47 hatchery-produced UCR steelhead smolts annually (2 percent indirect mortality level) is minimal when compared to the UCR steelhead populations.

Grant County PUD's personnel will implement the following measures to minimize injuries and mortalities: All fish handled will be held in flowing river water. When anesthetized, fish will remain in solution until they can be handled. All fish will be allowed to recover before being released. All equipment and procedures are designed to minimize adverse effects on fish. Dipnets are made from soft nylon, all fasteners are coated with silicone, and any contact surfaces are maintained smooth and free of burrs and debris. Anesthetized fish are placed into a surgical cradle lined with soft wet cloth to prevent injury. Back-up oxygen and water flow systems will be installed in the event there are problems with the main systems (Grant County PUD 1998). NMFS considers these to be adequate mitigation measures to limit adverse impacts to the listed fish.

5. Permit 1156 Modification 1

The proposed modification to EPA's existing permit would authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. The proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	35	35	70
Total non-lethal take	**35**	**35**	**70**
Indirect Mortality	1	1	2

Total lethal take	**1**	**1**	**2**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	45	45	90
Total non-lethal take	**45**	**45**	**90**
Indirect Mortality	1	1	2
Total lethal take	**1**	**1**	**2**

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon will occur in the Wenatchee River Basin. The specific locations are Minnow Creek (tributary of the Chiwawa River), Wenatchee River near Monitor, Wenatchee River near Leavenworth, Little Wenatchee River, unnamed tributary of Rock Creek (upper Chiwawa River), Chiwawa River (RM 2.0), and Nelson Creek (tributary of N. Fork Rattlesnake Creek). Based on last years research efforts (adult escapement, redd counts), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Wenatchee River in 2001 will be 38,475 (unpublished data, Chelan County PUD). The total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Wenatchee River is expected to be as high as 672,000 smolts annually when WDFW's planned hatchery supplementation program for the Wenatchee River Basin comes on line (WDFW 1998). NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 1 juvenile, endangered, artificially-propagated, UCR spring chinook salmon from the Wenatchee River population annually (2 percent indirect mortality level), is likely to have an impact on the population viability.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead will occur in the Wenatchee River Basin. The specific locations are Minnow Creek (tributary of the Chiwawa River), Wenatchee River near Monitor, Wenatchee River near Leavenworth, North Shaser Creek in the upper Peshastin Creek drainage, Little Wenatchee River, unnamed tributary of Rock Creek (upper Chiwawa River), Derby Canyon between Peshastin and Dryden, Chiwawa River (RM 2.0), and Crater Creek (tributary of Ruby Creek near Ross Lake). Based on last years research efforts (adult escapement, redd counts), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Wenatchee River in 2001 will be 25,786 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Wenatchee River in 2001 will be 153,573 (unpublished data, WDFW). NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 1 juvenile, endangered, artificially-propagated, UCR steelhead from the Wenatchee River population annually (2 percent indirect mortality level), is likely to impact the population viability.

To minimize electrofishing injury, the researchers will use a low pulse rate (30 pulses/s), a narrow pulse width (< 6msec), low peak voltage (500 V). These settings are much less damaging to larger fish, and although not as effective for collecting small fish, they do stimulate benthic species to move up into the water column where they are more easily netted. For the raft-mounted gear, the researchers will employ large cathodes (20 droppers) and 6 anode droppers to reduce the field strength in the vicinity of the electrodes and to allow the use of lower voltages. Stunned fish are recovered using a soft mesh dipnet and placed in a holding tank. Following the collection of biological information, the fish are placed back in the holding tank to recover before being released alive. When juvenile salmonids are observed to be harmed, the researchers will increase the pulse rate (which decreases the potential damage to small fish but increases the potential threat to larger fish). If large and small salmonids are present and the small ones show evidence of harm, the researchers will shorten the holding time in the live well. All operators of electrofishing equipment will be fully trained (EPA/Dynamac 2000) . NMFS considers these to be adequate measures to mitigate against adverse impacts from the research activities.

6. Permit 1203 Modification 1

The proposed modification of WDFW's existing permit expires would: (1) authorize adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, artificially-propagated, UCR steelhead to be observed/harassed during spawning ground surveys and carcass surveys in the Methow and Okanogan River Basins (Study 3); (2) authorize the collection and transportation of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with fish salvage operations in the Wenatchee River Basin; (3) authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead (Studies 1, 4, and 5); and (4) authorize the capture, handling, tagging, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead (Study 1). WDFW's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Collect for transport	100	5,000	5,000	10,100
Capture, handle, release	0	11,850	15,900	27,750
Capture, tag/mark, release	0	2,690	4,800	7,490
Total non-lethal take	**100**	**19,540**	**25,700**	**45,340**
Direct Mortality	0	0	0	0
Indirect Mortality	1	586	771	1,358

Total lethal take	**1**	**586**	**771**	**1,358**

UCR Steelhead

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Collect for transport	100	5,000	5,000	10,100
Capture, handle, release	30	21,020	4,900	25,950
Capture, tag/mark, release	0	2,080	1,200	3,280
Total non-lethal take	**130**	**28,100**	**11,100**	**39,330**
Direct Mortality	0	0	0	0
Indirect Mortality	1	843	333	1,177
Total lethal take	**1**	**843**	**333**	**1,177**

WDFW's non-lethal takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed spawning ground surveys and carcass surveys in the Methow, Okanogan, and Similkameen River Basins (Study 3) involve the temporary harassment of the fish using passive observation techniques. The effects of this form of harassment and methods to mitigate any adverse impacts are described in the general effects section above. The researchers will use the mitigation measures described to minimize impacts on the ESA-listed UCR spring chinook salmon and ESA-listed UCR steelhead adults and juveniles associated with Study 3.

The annual non-lethal takes of adult and juvenile, endangered, UCR spring chinook salmon due to WDFW's proposed salvage activities (up to 100 UCR spring chinook salmon adults, up to 5,000 naturally-produced UCR spring chinook salmon juveniles, and up to 5,000 artificially-propagated UCR spring chinook salmon juveniles) is not likely to operate to the disadvantage of the species since the purpose of the salvage operations is to directly enhance the survival of the species. In addition, the proposed salvage operations are not intended to emphasize one population type over another. However, depending on the relative scope, magnitude, and location of the trouble area, adverse environmental conditions, such as low water levels, could have a substantially greater impact on one population type over another. The purpose of the salvage activities is to assist the population types that are exposed to adverse environmental conditions where the need arises. With regard to the annual lethal take associated with WDFW's proposed salvage activities, NMFS believes that the loss of up to 1 adult, endangered, UCR spring chinook salmon (1 percent indirect mortality level); of up to 150 juvenile, endangered, naturally-produced, UCR spring chinook salmon (3 percent indirect mortality level); and of up to 150 juvenile, endangered, artificially-propagated, UCR spring chinook salmon (3 percent indirect mortality level), will have minimal effects given the population sizes. In fact WDFW's salvage operations are intended to enhance the survival of endangered UCR spring chinook salmon over the alternative of a more substantial mortality rate if the fish are not assisted.

The annual non-lethal takes of adult and juvenile, endangered, UCR steelhead due to WDFW's proposed salvage activities (up to 100 UCR steelhead adults, up to 5,000 naturally-produced UCR steelhead juveniles, and up to 5,000 artificially-propagated UCR steelhead juveniles) is not likely to operate to the disadvantage of the species since the purpose of the salvage operations is to directly enhance the survival of the species. In addition, the proposed salvage operations are not intended to emphasize one population type over another. However, depending on the relative scope, magnitude, and location of the trouble area, adverse environmental conditions, such as low water levels, could have a substantially greater impact on one population type over another. The purpose of the salvage activities is to assist the population types that are exposed to adverse environmental conditions where the need arises. With regard to the annual lethal take associated with WDFW's proposed salvage activities, NMFS believes that the loss of up to 1 adult, endangered, UCR steelhead (1 percent indirect mortality level); up to 150 juvenile, endangered, naturally-produced, UCR steelhead (3 percent indirect mortality level); and up to 150 juvenile, endangered, artificially-propagated, UCR steelhead (3 percent indirect mortality level), will not impair the population's viability in the Wenatchee River Basin. In fact, WDFW's salvage operations are intended to enhance the survival of endangered UCR steelhead over the alternative of a more substantial mortality rate if the fish are not assisted.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with Study 1 will occur in the Wenatchee River Basin. Permit 1203 already authorizes an annual take of juvenile, endangered, naturally-produced, UCR spring chinook salmon associated with Study 1 however, as explained in the *Description of the Proposed Actions* section above, WDFW has requested an increase in the annual take of naturally-produced UCR spring chinook salmon juveniles due to the proposed use of an additional smolt trap on the lower Wenatchee River. The specific locations where the research will be conducted are the Chiwawa River (approximately 600 m downstream of WDFW's Chiwawa Ponds hatchery facility), the Wenatchee River (just downstream from the outlet of Lake Wenatchee), and the lower Wenatchee River at Monitor, WA (Rkm 9.6). Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Wenatchee River in 2001 will be 38,475 (unpublished data, Chelan County PUD). The total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Wenatchee River is expected to be as high as 672,000 smolts annually when WDFW's planned hatchery supplementation program for the Wenatchee River Basin comes on line (WDFW 1998). NMFS does not believe that the loss of up to an additional 621 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 436 juvenile, endangered, artificially-propagated, UCR spring chinook salmon from the Wenatchee River population (3 percent indirect mortality level), will negatively impact the viability of the population.

The proposed non-lethal take of adult, endangered, UCR steelhead and the proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with Study 1 will occur in the Wenatchee River Basin. The specific locations where Study 1 will be conducted are the Chiwawa River (approximately 600 m downstream of WDFW's Chiwawa Ponds hatchery facility), the Wenatchee River (just downstream from the outlet of Lake Wenatchee), and the lower Wenatchee River at Monitor,

WA (Rkm 9.6). Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Wenatchee River in 2001 will be 25,786 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Wenatchee River in 2001 will be 153,573 (unpublished data, WDFW). Based on these numbers NMFS believes that the loss of up to 123 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 693 juvenile, endangered, artificially-propagated, UCR steelhead from the Wenatchee River population (3 percent indirect mortality level) will have a minimal impact on the population.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced, UCR steelhead associated with Studies 4 and 5 will occur throughout the upper Columbia River Basin. Because of the uncertainty as to which UCR steelhead populations will be impacted by the conduct of Studies 4 and 5 by WDFW, this analysis is not sensitive enough to evaluate the potential effects on endangered UCR steelhead at the population level. The analysis for Studies 4 and 5 assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole. For the purpose of this analysis, WDFW's proposed annual take of UCR steelhead juveniles for Studies 4 and 5 is compared with the estimated total ESA-listed juvenile steelhead production for the UCR Region in 2001. The ESA-listed juvenile steelhead outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 4, Appendix 4), will be used as the estimate for the total ESA-listed juvenile steelhead production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR steelhead juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR steelhead ESU. From Table 4 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the UCR Region in 2001 will be 224,300 (Schiewe 2001). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 60 juvenile, endangered, naturally-produced, UCR steelhead annually (3 percent indirect mortality level) will impact the viability of the population.

To minimize lethal takes, trained WDFW staff will operate the traps. Trap operations will be monitored on a daily basis. Captured fish will be lightly anesthetized and will be allowed to recover fully before being released. Live cars will be used to hold fish that require more recovery time prior to release. NMFS guidelines will be followed when using electrofishing as a collection technique. All fish will be handled in accordance with established WDFW protocols to minimize losses due to stress and disease (WDFW 1999a). NMFS considers these measures adequate to mitigate against adverse impacts resulting from WDFW's activities.

D. Proposed New Permits

1. Northern Wasco County People's Utility District - Permit 1229

The proposed permit for Northern Wasco County PUD's scientific research would authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. Northern Wasco County PUD's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	15	2	17
Total non-lethal take	**15**	**2**	**17**
Direct Mortality	0	0	0
Indirect Mortality	1	0	1
Total lethal take	**1**	**0**	**1**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	21	4	25
Total non-lethal take	**21**	**4**	**25**
Direct Mortality	0	0	0
Indirect Mortality	1	0	1
Total lethal take	**1**	**0**	**1**

The takes of ESA-listed UCR spring chinook salmon and ESA-listed UCR steelhead associated with Northern Wasco County PUD's scientific research activities will occur at The Dalles Dam on the mainstem Columbia River. Researchers are not able to distinguish between the different ESA-listed fish populations when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the effects due to proposed research activities on ESA-listed UCR spring chinook salmon and ESA-listed UCR steelhead at the population level. The analysis for this permit assumes that the status of the each affected population is the same as the ESU as a whole.

The annual non-lethal and lethal takes of UCR spring chinook salmon juveniles due to Northern Wasco County PUD's research activities are not likely to result in a substantially greater impact to any one population over another since the probability of being subjected to collection for research purposes is equivalent for all population types at The Dalles Dam. Also, the research activities are not intended to emphasize one population type over another. For the purpose of this analysis, Northern Wasco County PUD's proposed annual takes of UCR spring chinook

salmon juveniles is compared with the total ESA-listed UCR spring chinook salmon juveniles estimated to emigrate to The Dalles Dam in 2001. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced UCR spring chinook salmon juveniles expected to reach The Dalles Dam in 2001 will be 3,617 and the total number of artificially-propagated UCR spring chinook salmon juveniles expected to reach The Dalles Dam in 2001 will be 13,747 (calculated from Table 3, Appendix 4). If the estimated emigration for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 1 hatchery-produced UCR spring chinook salmon smolt annually (3 percent indirect mortality level), will have a minimal effect on the population.

The annual non-lethal and lethal takes of UCR steelhead juveniles due to Northern Wasco County PUD's research activities are not likely to result in a substantially greater impact to any one population over another since the probability of being subjected to collection for research purposes is equivalent for all population types at The Dalles Dam. Also, the research activities are not intended to emphasize one population type over another. For the purpose of this analysis, Northern Wasco County PUD's proposed annual takes of UCR spring chinook salmon juveniles is compared with the total ESA-listed UCR spring chinook salmon juveniles estimated to emigrate to The Dalles Dam in 2001. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced UCR steelhead juveniles expected to reach The Dalles Dam in 2001 will be 7,259 (calculated from Table 4, Appendix 4) and the total number of artificially-propagated UCR spring chinook salmon juveniles expected to reach The Dalles Dam in 2001 will be 21,796 (Table 4, Appendix 4). If the estimated emigration for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 1 hatchery-produced UCR steelhead smolt annually (3 percent indirect mortality level) will have minimal effects on the population.

Northern Wasco County PUD will implement measures to minimize the impacts to ESA-listed juvenile fish. An initial verification of suitable passage conditions occurs in late March, before the sampling season begins. Fish interception is by diversion into an overflow tank with removal only for examination prior to return to an anesthetic recovery tank and inwater release for return to the river. No fish are detained after examination. The fish diversion and tank are carefully inspected before, during, and after each day's sampling for proper operation, debris removal, tank cover (to prevent bird predation), or other concerns. No sampling is scheduled when forebay levels are scheduled to be below the minimum operating level for fish sampling apparatus to avoid fish strandings in the diversion pipes (Northern Wasco County PUD 1999). NMFS considers these to be adequate mitigation measures.

2. Douglas County Public Utility District - Permit 1246

The proposed permit for Douglas County PUD's scientific research would: (1) authorize adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead to be observed/harassed during snorkel surveys, spawning ground surveys, and carcass surveys in the Methow River Basin (Tasks 1 and 2); (2) authorize the collection and transportation of juvenile, endangered, naturally-produced, UCR spring chinook salmon and

juvenile, endangered, naturally-produced, UCR steelhead associated with fish salvage operations in the Methow River Basin; (3) authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with Tasks 2 and 3; (4) authorize the capture, handling, marking, and release of ESA-listed juvenile fish to estimate snorkeling efficiency (Task 2), to estimate trap efficiencies (Task 3); (5) authorize the capture, handling, marking and release of adult, endangered, UCR steelhead kelts for Task 3; and (6) authorize, an intentional lethal take of juvenile, endangered, naturally-produced, UCR spring chinook salmon for archival and/or genetic analysis for Task 3. Douglas County PUD's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Collect for transport	0	8,000	8,000
Capture, handle, release	80	400	480
Capture, tag/mark, release	300	1,500	1,800
Total non-lethal take	**380**	**9,900**	**10,280**
Direct Mortality	0	50	50
Indirect Mortality	11	297	308
Total lethal take	**11**	**347**	**358**

UCR Steelhead

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Collect for transport	0	0	250	250
Capture, handle, release	5	20	130	155
Capture, tag/mark, release	0	150	80	230
Total non-lethal take	**5**	**170**	**460**	**635**
Direct Mortality	0	0	0	0
Indirect Mortality	0	5	14	19
Total lethal take	**0**	**5**	**14**	**19**

Douglas County PUD's non-lethal takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the proposed snorkel surveys, spawning ground surveys, and carcass surveys in the Methow River Basin (Tasks 1 and 2) involve the temporary harassment of the fish using passive observation

techniques. The effects of harassment from observation are discussed in the general effects portion of this section. The researchers will use the mitigation measures previously discussed to minimize adverse impacts from the observation. In addition to the stream surveys, Douglas County PUD will collect ESA-listed fish carcasses and sample them for tissues and scales and its researchers will use the same measures to minimize fish disturbance.

The annual non-lethal take of juvenile, endangered, naturally-produced, UCR spring chinook salmon due to Douglas County PUD's proposed salvage activities (up to 8,000 naturally-produced UCR spring chinook salmon juveniles) is not likely to operate to the disadvantage of the species since the purpose of the salvage operations is to directly enhance the survival of the species. In addition, the proposed salvage operations are not intended to emphasize one population type over another. However, depending on the relative scope, magnitude, and location of the trouble area, adverse environmental conditions, such as low water levels, could have a substantially greater impact on one population type over another. The purpose of the salvage activities is to assist the population types that are exposed to adverse environmental conditions where the need arises. With regard to the annual lethal take associated with Douglas County PUD's proposed salvage activities, NMFS does not believe that the loss of up to 240 juvenile, endangered, naturally-produced, UCR spring chinook salmon (3 percent indirect mortality level), in proportion to the overall population, will negatively impact the population's viability. In fact, Douglas County PUD's salvage operations are intended to enhance the survival of endangered UCR spring chinook salmon over the alternative of a more substantial mortality rate if the fish are not assisted.

The annual non-lethal take of juvenile, endangered, naturally-produced, UCR steelhead due to Douglas County PUD's proposed salvage activities (up to 250 naturally-produced UCR steelhead juveniles) is not likely to operate to the disadvantage of the species since the purpose of the salvage operations is to directly enhance the survival of the species. In addition, the proposed salvage operations are not intended to emphasize one population type over another. However, depending on the relative scope, magnitude, and location of the trouble area, adverse environmental conditions, such as low water levels, could have a substantially greater impact on one population type over another. The purpose of the salvage activities is to assist the population types that are exposed to adverse environmental conditions where the need arises. With regard to the annual lethal take associated with Douglas County PUD's proposed salvage activities, NMFS does not believe that the loss of up to 8 juvenile, endangered, naturally-produced, UCR steelhead (3 percent indirect mortality level), in proportion to the overall population will negatively impact the population's viability. In fact, Douglas County PUD's salvage operations are intended to enhance the survival of endangered UCR steelhead over the alternative of a more substantial mortality rate if the fish are not assisted.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with Tasks 2 and 3 will occur in the Methow River Basin. The capture and handling of ESA-listed spring chinook salmon juveniles associated with Task 2 will occur wherever snorkel surveys are to be conducted (throughout the Methow River Basin). The specific locations where screw traps will be located (Task 3) are the Twisp River, the Chewuch River (RM 0.1-3.0), and the lower Methow River (RM 39). Douglas County PUD has also requested an intentional lethal take of up to 50

juvenile, endangered, naturally-produced, UCR spring chinook salmon for subsequent archival and/or genetic analysis. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 25,650 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 424,000 (unpublished data, WDFW). Given these population numbers, NMFS believes that the loss of up to 107 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 11 juvenile, endangered, artificially-propagated, UCR spring chinook salmon from the Methow River population (3 percent indirect mortality level) will have very little impact on the population.

The proposed non-lethal take of adult, endangered, UCR steelhead and the proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with Tasks 2 and 3 will occur in the Methow River Basin. The capture and handling of ESA-listed steelhead juveniles associated with Task 2 will occur wherever snorkel surveys are to be conducted (throughout the Methow River Basin). The specific locations where screw traps will be located (Task 3) are the Twisp River, the Chewuch River (RM 0.1-3.0), and the lower Methow River (RM 39). Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Methow River in 2001 will be 158,301 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Methow River in 2001 will be 520,318 (unpublished data, WDFW). Given these numbers, NMFS does not believe that the loss of up to 6 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 5 juvenile, endangered, artificially-propagated, UCR steelhead from the Methow River population (3 percent indirect mortality level), is likely to have much impact on the population.

Douglas County PUD will implement the following measures to minimize impacts to ESA-listed fish, which NMFS considers adequate to minimize adverse affects from its activities. Fish collected with nets will be moved from the nets into large buckets in a safe and rapid manner. Prior to release, the fish will have recovered completely from the effects of the anesthetic. The screw traps to be used during the juvenile fish migratory studies will move detained fish from the river into a live well without being lifted out of the water. The live well will be checked often to guard against overcrowding and stress (Douglas County PUD 1999). To minimize impacts, indirect mortalities of ESA-listed juvenile fish will be used in place of direct mortalities when possible.

3. Washington Department of Transportation - Permit 1252

The proposed permit for WDOT's scientific research would: (1) authorize juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead to be observed/harassed during snorkel surveys throughout the UCR Basin; and, (2) authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. WDOT's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	20	12	32
Total non-lethal take	**20**	**12**	**32**
Direct Mortality	0	0	0
Indirect Mortality	1	1	2
Total lethal take	**1**	**1**	**2**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	20	10	30
Total non-lethal take	**20**	**10**	**30**
Direct Mortality	0	0	0
Indirect Mortality	1	1	2
Total lethal take	**1**	**1**	**2**

WDOT's proposed takes of juvenile, endangered, UCR spring chinook salmon and juvenile, endangered, UCR steelhead will occur in watersheds throughout the UCR Basin. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the potential effects on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of the each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

WDOT's non-lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the proposed snorkel surveys involve the temporary harassment of the fish using passive observation techniques. The effects of harassment from observation are discussed in the general effects portion of this section. WDOT researchers will use the mitigation measures referred to there to minimize disruption and adverse effects to the ESA-listed UCR spring chinook salmon and ESA-listed UCR steelhead juveniles.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with WDOT's scientific research will occur throughout the upper Columbia River Basin. For the purpose of this analysis, WDOT's proposed annual take of UCR spring chinook salmon juveniles for the research is compared with the estimated total ESA-listed juvenile spring chinook salmon production for the UCR Region in 2001. The ESA-listed juvenile spring chinook salmon outmigration runsize

estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 3, Appendix 4), will be used as the estimate for the total ESA-listed juvenile spring chinook salmon production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR spring chinook salmon juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR spring chinook salmon ESU. From Table 3 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 76,565 and the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 290,889 (Schiewe 2001). If the estimated production for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 1 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (3 percent indirect mortality level), will have an on the population's viability.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with WDOT's scientific research will occur throughout the upper Columbia River Basin. For the purpose of this analysis, WDOT's proposed annual take of UCR steelhead juveniles for the research is compared with the estimated total ESA-listed juvenile steelhead production for the UCR Region in 2001. The ESA-listed juvenile steelhead outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 4, Appendix 4), will be used as the estimate for the total ESA-listed juvenile steelhead production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR steelhead juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR steelhead ESU. From Table 4 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the UCR Region in 2001 will be 224,300 and the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the UCR Region in 2001 will be 658,889 (Schiewe 2001). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 1 juvenile, endangered, artificially-propagated, UCR steelhead annually (3 percent indirect mortality level), will have an impact on the population's viability.

WDOT will implement the following measures to minimize impacts to ESA-listed fish, which NMFS considers adequate to minimize adverse impacts from WDOT's activities. The survey method to be used will be dependent on the size of the system to be surveyed. Sampling, with the exception of baited minnow traps, will be used for short durations and shall be targeted at pools and riffles. Fish will not be removed from the water unless absolutely necessary. Baited

minnow traps will be checked daily. In rare cases, electroshocking may be used. Electroshocking will be avoided in waters where water temperatures are very high (> 24°C) or very low (< 4°C). No form of alternating current output will be used while electrofishing. No electrofishing will be conducted when samplers can not see the stream bottom in one foot of water. The biologist will start electrofishing with straight direct current at a low voltage 200 output range and slowly running it up until a fish can be netted. Fish will be quickly identified and released to a calm part of the stream (WDOT 2000).

4. Northwest Fisheries Science Center, NMFS - Permit 1290

The proposed permit for NWFSC's scientific research would: (1) would authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead (Study 1); and (2) authorize an intentional lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon for pathogen analysis (Study 2). Any juvenile, endangered, UCR spring chinook salmon indirect mortalities are proposed to be retained for Study 2 in the place of intentional lethal takes. NWFSC's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	21	21	42
Total non-lethal take	**21**	**21**	**42**
Direct Mortality	6	4	10
Indirect Mortality	0	0	0
Total lethal take	**6**	**4**	**10**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	32	7	39
Total non-lethal take	**32**	**7**	**39**
Direct Mortality	0	0	0
Indirect Mortality	0	0	0
Total lethal take	**0**	**0**	**0**

NWFSC's proposed takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead will occur in the estuary of the Columbia River. NWFSC's personnel are not able to distinguish between the different populations of UCR spring

chinook salmon and UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the effects due to the proposed activities on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with NWFSC's scientific research will occur in the estuary of the Columbia River. For the purpose of this analysis, NWFSC's proposed annual takes of UCR spring chinook salmon juveniles is compared with the total ESA-listed UCR spring chinook salmon juveniles estimated to emigrate to the point in the mainstem river that is closest to the Columbia River estuary in 2001. That point in the mainstem river for which UCR spring chinook salmon emigration estimates are available is Tongue Point, which is located in the Columbia River estuary. The juvenile, endangered, naturally-produced, UCR spring chinook salmon outmigration runsize estimate at Tongue Point under the full transportation (no spill) scenario in 2001 will be 39,188 and the juvenile, endangered, artificially-propagated, UCR spring chinook salmon outmigration runsize estimate at Tongue Point under the full transportation (no spill) scenario in 2001 will be 197,732, as calculated from Schiewe 2001 (Table 3, Appendix 4). If the estimate for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS believes that the loss of up to 4 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 6 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (intentional lethal takes in the place of indirect mortalities), will have little impact on the population.

The proposed non-lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with NWFSC's scientific research will occur in the estuary of the Columbia River. For the purpose of this analysis, NWFSC's proposed annual take of UCR steelhead juveniles is compared with the total ESA-listed UCR steelhead juveniles estimated to emigrate to the point in the mainstem river that is closest to the Columbia River estuary in 2001. That point in the mainstem river for which UCR steelhead emigration estimates are available is Tongue Point, which is located in the Columbia River estuary. The juvenile, endangered, naturally-produced, UCR steelhead outmigration runsize estimate at Tongue Point under the full transportation (no spill) scenario in 2001 will be 155,402 and the juvenile, endangered, artificially-propagated, UCR steelhead outmigration runsize estimate at Tongue Point under the full transportation (no spill) scenario in 2001 will be 523,588, as calculated from Schiewe 2001 (Table 4, Appendix 4). If the estimate for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS believes that the non-lethal take of up to 7 juvenile, endangered, naturally-produced, UCR steelhead and the non-lethal take of up to 32 juvenile, endangered, artificially-propagated, UCR steelhead annually, will minimally impact the population. No lethal takes of ESA-listed UCR steelhead juveniles will be authorized by the permit.

To minimize impacts to ESA-listed fish, NWFSC will use the following measures. Using the small purse seine technique juvenile salmonids are continuously kept in water and not exposed to undue stress. The seine is relatively small so the total catches of salmonids and non-salmonids per set should be relatively low, reducing any effects of crowding. The cod end of the beach seine is never pulled completely out of the water to minimize stress to all captured fish. All possible steps will be taken to remove fish from the seines as quickly and gently as possible. Sanctuary dip nets are used to remove fish from the seines and thus, all fish are kept in estuarine water at all times. After capture, all salmonids will be held in buckets with running water until they fully recover from capture and measurement operations (unless chosen to be taken lethally). After recovery, the salmonids not chosen to be taken lethally will be carefully released back into the water (NWFSC 2001). NMFS considers these measures adequate to minimize any adverse impacts from the NWFSC proposed activities.

5. U.S. Geological Survey - Permit 1291

The proposed permit for USGS's scientific research would: (1) authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead; and (2) authorize the capture, handling, tagging, and release of juvenile, endangered, naturally-produced, UCR steelhead. USGS's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	4,592	402	4,994
Total non-lethal take	**4,592**	**402**	**4,994**
Direct Mortality	0	0	0
Indirect Mortality	138	12	150
Total lethal take	**138**	**12**	**150**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	10,662	1,511	12,173
Capture, tag/mark, release	0	151	151
Total non-lethal take	**10,662**	**1,662**	**12,324**
Direct Mortality	0	0	0
Indirect Mortality	320	50	370
Total lethal take	**320**	**50**	**370**

USGS's proposed takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-

propagated, UCR steelhead will occur at John Day and Bonneville Dams on the lower Columbia River. USGS and SMP personnel are not able to distinguish between the different populations of UCR spring chinook salmon and UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the effects due to the proposed activities on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

The annual non-lethal and lethal takes of UCR spring chinook salmon juveniles due to USGS's research activities are not likely to result in a substantially greater impact to any one population over another since the probability of being subjected to collection for research purposes is equivalent for all population types at John Day and Bonneville Dams. Also, the research activities are not intended to emphasize one population type over another. For the purpose of this analysis, USGS's proposed annual takes of UCR spring chinook salmon juveniles is compared with the total ESA-listed UCR spring chinook salmon juveniles estimated to emigrate to John Day Dam in 2001, as John Day Dam is USGS's primary collection point for obtaining juvenile fish for the research (Bonneville Dam is the secondary collection point). According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced UCR spring chinook salmon juveniles expected to reach John Day Dam in 2001 will be 6,028 and the total number of artificially-propagated UCR spring chinook salmon juveniles expected to reach John Day Dam in 2001 will be 22,912 (calculated from Table 3, Appendix 4). If the estimated emigration for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 12 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 138 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (3 percent indirect mortality level), will have much impact on the population

The annual non-lethal and lethal takes of UCR steelhead juveniles due to USGS's research activities are not likely to result in a substantially greater impact to any one population over another since the probability of being subjected to collection for research purposes is equivalent for all population types at John Day and Bonneville Dams. Also, the research activities are not intended to emphasize one population type over another. For the purpose of this analysis, USGS's proposed annual takes of UCR steelhead juveniles is compared with the total ESA-listed UCR steelhead juveniles estimated to emigrate to John Day Dam in 2001, as John Day Dam is USGS's primary collection point for obtaining juvenile fish for the research (Bonneville Dam is the secondary collection point). According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2001 outmigration season (Schiewe 2001), the total number of naturally-produced UCR steelhead juveniles expected to reach John Day Dam in 2001 will be 11,331 and the total number of artificially-propagated UCR steelhead juveniles expected to reach John Day Dam in 2001 will be 33,905 (calculated from Table 4, Appendix 4). If the estimated emigration for the 2001 juvenile steelhead outmigration season is assumed to be

typical for future years, NMFS believes that the loss of up to 50 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 320 juvenile, endangered, artificially-propagated, UCR steelhead annually (3 percent indirect mortality level), will minimally affect the population.

USGS will implement the following measures to minimize impacts to ESA-listed fish: Fish with PIT tags will not be tagged with radiotransmitters. As fish are moved through the tanks at the dams, thorough examinations will be made to ensure that fish will not be impinged by tank hardware. Fish will be anesthetized and sorted in small batches and with all possible speed to ensure that they are not unnecessarily exposed to anesthesia. The implantation of transmitters will be completed as quickly and safely as possible, always with consideration of fish condition. Steps are taken throughout the implantation procedures to ensure the well-being of the fish. For example, USGS uses an artificial slime restorer and a buffer when fish are anesthetized. USGS also administers antibiotics intraperitoneally and disinfects all surgical instruments to protect the fish from infection. USGS will modify the implantation technique to the size and condition of the fish to minimize the stress associated with tagging. Fish are netted only when necessary and only with sanctuary nets. Oxygen and high-flow water are provided to aid the fish in recovering from the tagging procedures (USGS 2001). NMFS considers these to be adequate measures to minimize any adverse impacts from USGS' activities.

6. U.S. Forest Service - Permit 1292

The proposed permit for USFS's scientific research would authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and the capture, handling, marking, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. USFS's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	133	34	167
Total non-lethal take	**133**	**34**	**167**
Direct Mortality	0	0	0
Indirect Mortality	4	1	5
Total lethal take	**4**	**1**	**5**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, tag/mark, release	137	35	172
Total non-lethal take	**137**	**35**	**172**
Direct Mortality	0	0	0
Indirect Mortality	4	1	5

Total lethal take	**4**	**1**	**5**

USFS's proposed takes of juvenile, endangered, UCR spring chinook salmon and juvenile, endangered, UCR steelhead will occur in watersheds throughout the UCR Basin. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the potential effects on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of the each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with USFS's scientific research will occur in various streams and tributaries in the Wenatchee River Basin, the Entiat River Basin, and the Methow River Basin. For the purpose of this analysis, USFS's proposed annual take of UCR spring chinook salmon juveniles for the research is compared with the estimated total ESA-listed juvenile spring chinook salmon production for the UCR Region in 2001. The ESA-listed juvenile spring chinook salmon outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 3, Appendix 4), will be used as the estimate for the total ESA-listed juvenile spring chinook salmon production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR spring chinook salmon juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR spring chinook salmon ESU. From Table 3 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 76,565 and the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 290,889 (Schiewe 2001). If the estimated production for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 4 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (3 percent indirect mortality level), will have much impact on the population.

The proposed non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with USFS's scientific research will occur in various streams and tributaries in the Wenatchee River Basin, the Entiat River Basin, and the Methow River Basin. For the purpose of this analysis, USFS's proposed annual take of UCR steelhead juveniles for the research is compared with the estimated total ESA-listed juvenile steelhead production for the UCR Region in 2001. The ESA-listed juvenile steelhead outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 4, Appendix 4), will be used as the estimate for the total ESA-listed juvenile steelhead production in the UCR Region. The outmigration runsize

estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR steelhead juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR steelhead ESU. From Table 4 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the UCR Region in 2001 will be 224,300 and the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the UCR Region in 2001 will be 658,889 (Schiewe 2001). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR steelhead and the loss of up to 4 juvenile, endangered, artificially-propagated, UCR steelhead annually (3 percent indirect mortality level), will have much impact on the population.

USFS will implement the following measures which NMFS considers adequate to minimize impacts to the ESA- listed fish. Fish sampled will be collected by angling with flies with barbless hooks to reduce potential harassment, injury, or mortality compared to other capture methods. No sampling will be done during steelhead spawning or chinook salmon spawning in the areas where those species occur. Sample fish will be temporarily placed in livenets in the stream or aerated buckets with cool water, minimally anesthetized with CO_2 to facilitate handling and reduce stress, and examined for phenotypic characteristics in a small plastic bag with water. The fish will then be carefully sampled for an approximately 5x5 mm section of tissue (removed from both caudal lobes with a razor blade), allowed to recover from the anesthetic, and returned to the stream (USFS 2001).

7. Northern Resource Consulting - Permit 1293

The proposed permit for NRC's scientific research would: (1) authorize juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead to be observed/harassed during snorkel surveys throughout the UCR Basin; and (2) authorize the capture, handling, and release of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead. No lethal takes of ESA-listed fish will be authorized by the proposed permit. NRC's proposed annual takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	2	4	6
Total non-lethal take	**2**	**4**	**6**
Direct Mortality	0	0	0
Indirect Mortality	0	0	0
Total lethal take	**0**	**0**	**0**

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, handle, release	3	9	12
Total non-lethal take	**3**	**9**	**12**
Direct Mortality	0	0	0
Indirect Mortality	0	0	0
Total lethal take	**0**	**0**	**0**

NRC's proposed takes of juvenile, endangered, UCR spring chinook salmon and juvenile, endangered, UCR steelhead will occur in watersheds throughout the UCR Basin. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon or endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the research, this analysis is not sensitive enough to evaluate the potential effects on endangered UCR spring chinook salmon and endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of the each affected population of UCR spring chinook salmon and UCR steelhead is the same as each respective ESU as a whole.

NRC's non-lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the proposed snorkel surveys involve the temporary harassment of the fish using passive observation techniques. The effects of harassment resulting from observation are discussed in the general effects portion of this section, together with measures typically used by researchers to minimize the adverse effects from observation activities. Because the NRC researchers will use those techniques. NMFS expects any adverse impacts on the listed fish to be minimal, and anticipates no ESA-listed fish injuries or mortalities from NRC's passive observation activities.

The proposed non-lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with NRC's scientific research will occur in streams and tributaries throughout the UCR Basin. For the purpose of this analysis, NRC's proposed annual take of UCR spring chinook salmon juveniles for the research is compared with the estimated total ESA-listed juvenile spring chinook salmon production for the UCR Region in 2001. The ESA-listed juvenile spring chinook salmon outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 3, Appendix 4), will be used as the estimate for the total ESA-listed juvenile spring chinook salmon production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR spring chinook salmon juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR spring chinook salmon ESU. From Table 3 (Appendix 4), the estimated total production of

ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 76,565 and the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the UCR Region in 2001 will be 290,889 (Schiewe 2001). If the estimated production for the 2001 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the non-lethal take of up to 4 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the non-lethal take of up to 2 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually, will have much impact on the population. No lethal takes of ESA-listed UCR spring chinook salmon juveniles will be authorized by the permit.

The proposed non-lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with NRC's scientific research will occur in streams and tributaries throughout the UCR Basin. For the purpose of this analysis, NRC's proposed annual take of UCR steelhead juveniles for the research is compared with the estimated total ESA-listed juvenile steelhead production for the UCR Region in 2001. The ESA-listed juvenile steelhead outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario, obtained from Schiewe 2001 (Table 4, Appendix 4), will be used as the estimate for the total ESA-listed juvenile steelhead production in the UCR Region. The outmigration runsize estimate at Rock Island Dam is used as a whole-basin production estimate because the majority of outmigrating UCR steelhead juveniles will have entered the mainstem river upstream of this location (more than 80 percent of the ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR steelhead ESU. From Table 4 (Appendix 4), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the UCR Region in 2001 will be 224,300 and the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the UCR Region in 2001 will be 658,889 (Schiewe 2001). If the estimated production for the 2001 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the non-lethal take of up to 9 juvenile, endangered, naturally-produced, UCR steelhead and the non-lethal take of up to 3 juvenile, endangered, artificially-propagated, UCR steelhead annually, will have much impact on the population.

NRC will implement the following measures, which NMFS considers adequate to minimize impacts to ESA-listed fish. If the riparian habitat is open and the stream is readily accessible or a visual identification is easily established, no electrofishing will be necessary. If electrofishing is used, no handling of the fish outside of the water will occur. NMFS backpack electrofishing guidelines (NMFS 2000) will be followed. Trained staff who are knowledgeable in conducting electrofishing and have a proven record of using the gear without causing injuries to fish will be used (NRC 2001).

E. Cumulative Take Analysis

For the proposed actions that occur in the mainstem river, the relative risk to the ESA-listed species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adult and juvenile) caused by the proposed actions to recent estimates of the

total number of fish (for that life stage) present in the ESU as a whole. The annual maximum mortality level of each affected life stage (adult and juvenile) resulting from the proposed actions that are likely to cause mortalities (from the tables below) is then expressed as a percentage of the estimated total number of fish in each ESA-listed salmonid ESU.

The cumulative take analysis for the proposed actions that occur in tributary areas assumes that the effects to the ESA-listed fish are best represented by describing the effects to the specific populations present in the ESU. For the proposed actions that occur in the tributary areas, the relative risk to the ESA-listed species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adult and juvenile) caused by the proposed actions to recent estimates of the total number of fish (for the life stage) present in each affected population. The annual maximum mortality level of each affected life stage (adult and juvenile) resulting from the proposed actions that are likely to cause mortalities (from the tables below) is then expressed as a percentage of the estimated total number of fish in each ESA-listed salmonid population affected by the proposed actions.

1. Effects on Juvenile UCR Spring Chinook Salmon

Mainstem Columbia River

The following table summarizes the cumulative annual non-lethal take of juvenile, endangered, UCR spring chinook salmon that could potentially result in lethal take (collect for transport; capture, handle, release; capture, tag/mark, release) in the mainstem Columbia River. The observe/harass take category and the handling of ESA-listed fish carcasses will not be enumerated in the proposed permit actions and therefore, are not included in the table (these activities are not likely to result in any mortalities of ESA-listed chinook salmon). The following table also summarizes the cumulative annual lethal take of juvenile, endangered, UCR spring chinook salmon associated with the proposed actions that will occur in the mainstem Columbia River. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Chinook	Mortality of Naturally-Spawned Juvenile UCR Chinook	Non-lethal Take of Artificially-Propagated Juvenile UCR Chinook	Mortality of Artificially-Propagated Juvenile UCR Chinook	Total Mortality
Chelan PUD - 1115	7,032	141	37,218	744	885
Grant PUD - 1141	60,000	600	540,000	5,400	6,000
N. Wasco PUD - 1229	2	0	15	1	1
NWFSC - 1290	21	4	21	6	10
USGS - 1291	402	12	4,592	138	150
Totals	**67,457**	**757**	**581,846**	**6,289**	**7,046**

The proportional effect of annual juvenile chinook salmon mortalities resulting from the proposed actions that occur in the mainstem Columbia River was estimated by dividing the number of estimated mortalities by the estimated annual juvenile smolt abundance for the ESU as a whole. ESA-listed chinook salmon smolt abundance was estimated using an algorithm developed by NMFS' Northwest Fisheries Science Center for the 2001 juvenile chinook salmon outmigration season (Schiewe 2001; Appendix 4). Table 3 in Appendix 4 provides the ESA-listed juvenile chinook salmon outmigration estimates for 2001 at each of the hydropower dams on the mainstem Snake and Columbia Rivers. It should be noted that the juvenile outmigration estimates in Table 3 are provided in two scenarios that vary with regard to the extent of juvenile fish transportation and the relative amount of spill at the dams: Full transportation (no spill) and full transportation with spill. For the analyses in this consultation, the estimates under the full transportation (no spill) scenario will be used since that is the applicable scenario for the 2001 outmigration season. It should also be noted that the abundance estimates provided in Table 3 will be revised in future years as more complete information is acquired. One of the objectives of some of the proposed research addressed in this consultation is to obtain data that will be used to improve the precision of the abundance estimates in subsequent years.

From the above table, the cumulative annual mortality of juvenile UCR spring chinook salmon for the activities proposed to occur in the mainstem Columbia River is 757 naturally-spawned juveniles and 6,289 artificially-propagated juveniles. NMFS expects actual annual mortalities from each of the research projects to be less than the authorized amount because researchers have a tendency to overestimate their annual take in order to have the flexibility to make inseason adjustments to research protocols in response to annual fluctuations in environmental conditions such as inriver water flows. Since ESA-listed juvenile salmonid abundance tends to vary considerably from year-to-year, high levels of take are also requested by researchers to be prepared for a year when ESA-listed juvenile fish are abundant and the actual take is likely to be relatively high. Also, high estimates of take are useful for NMFS' analyses of effects because they allow the inclusion of take associated with accidental events that could result in mortalities that exceed expectations.

To estimate the significance of the projected mortality levels, cumulative mortalities of UCR spring chinook salmon are divided by the outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario (from Table 3). The outmigration runsize estimate at Rock Island Dam is used because the majority of outmigrating UCR spring chinook salmon juveniles will have entered the mainstem river upstream of this location (more than 80 percent of this ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR spring chinook salmon ESU. Percent mortality of juvenile, endangered, naturally produced, UCR spring chinook salmon associated with the proposed actions to occur in the mainstem Columbia River is 0.99 percent (757/76,565). Percent mortality of juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with the proposed actions to occur in the mainstem Columbia River is 2.16 percent (6,289/290,889).

NMFS concludes that the annual non-lethal take of up to 67,457 juvenile, endangered, naturally-produced, UCR spring chinook salmon that is proposed to occur in the mainstem Columbia

River and the annual non-lethal take of up to 581,846 juvenile, endangered, artificially-propagated, UCR spring chinook salmon that is proposed to occur in the mainstem Columbia River, together with the annual lethal take of up to 757 juvenile, endangered, naturally-produced, UCR spring chinook salmon that is proposed to occur in the mainstem Columbia River and the annual lethal take of up to 6,289 juvenile, endangered, artificially-propagated, UCR spring chinook salmon that is proposed to occur in the mainstem Columbia River will not appreciably reduce the likelihood of survival and recovery of the species in the wild. This conclusion assumes that the loss of up to 7,046 UCR spring chinook salmon juveniles annually will not, individually or cumulatively, appreciably reduce the size or distribution of the affected populations or their ability to recover from the losses expected from the proposed actions. Adequate measures are in place to minimize the effects of the non-lethal take. The annual loss of up to 7,046 juveniles out of an estimated population of 367,454 in 2001 is not expected to appreciably reduce the reproductive capacity or distribution of any population of UCR spring chinook salmon or appreciably reduce their ability to recover from endangerment.

Tributary Areas

The following table summarizes the cumulative annual non-lethal take of juvenile, endangered, UCR spring chinook salmon that has the potential to result in lethal take (collect for transport; capture, handle, release; capture, tag/mark, release) associated with the proposed actions that will occur in the tributary areas of the species' ESU. The observe/harass take category and the handling of ESA-listed fish carcasses will not be enumerated in the proposed permit actions and therefore, are not included in the table (these activities are not likely to result in any mortalities of ESA-listed chinook salmon). The following table also summarizes the cumulative annual lethal take of juvenile, endangered, UCR spring chinook salmon associated with the proposed actions that will occur in the tributary areas of the ESU. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Chinook	Mortality of Naturally-Spawned Juvenile UCR Chinook	Non-lethal Take of Artificially-Propagated Juvenile UCR Chinook	Mortality of Artificially-Propagated Juvenile UCR Chinook	Total Mortality
EPA - 1156	35	1	35	1	2
WDFW - 1203	25,700	771	19,540	586	1,357
Douglas PUD - 1246	9,900	347	380	11	358
WDOT - 1252	12	1	20	1	2
USFS - 1292	34	1	133	4	5
NRC - 1293	4	0	2	0	0
Totals	**35,685**	**1,121**	**20,110**	**603**	**1,724**

For the takes of juvenile, endangered, UCR spring chinook salmon that are proposed to occur in the tributary areas of the ESU, the analysis of cumulative impacts is best derived by determining the relative impacts of proposed activities on the specific populations of the species in the specific tributary areas where the activities are proposed to occur. The individual analyses for

each proposed permit action to take place in a tributary area of the UCR spring chinook salmon ESU are located above under sections V.A. and V.B., *Analysis of the Effects of the Proposed Actions*.

The relative risk due to cumulative impacts could be significant to a specific population of chinook salmon if more than one of the proposed actions are to occur in the same geographic area or watershed within the boundaries of the ESU. The following 3 tables indicate the proposed non-lethal and lethal takes by major tributary watershed (Wenatchee River, Entiat River, Methow River). For the research projects that are proposed to occur in all three major tributary watersheds (indicated previously as occurring throughout the UCR Basin), this analysis will assume that the total requested take will occur entirely in each individual watershed and will be included in each table.

Wenatchee River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Chinook	Mortality of Naturally-Spawned Juvenile UCR Chinook	Non-lethal Take of Artificially-Propagated Juvenile UCR Chinook	Mortality of Artificially-Propagated Juvenile UCR Chinook	Total Mortality
EPA - 1156	35	1	35	1	2
WDFW - 1203	25,700	771	19,540	586	1,357
WDOT - 1252	12	1	20	1	2
USFS - 1292	34	1	133	4	5
NRC - 1293	4	0	2	0	0
Totals	**25,785**	**774**	**19,730**	**592**	**1,366**

Entiat River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Chinook	Mortality of Naturally-Spawned Juvenile UCR Chinook	Non-lethal Take of Artificially-Propagated Juvenile UCR Chinook	Mortality of Artificially-Propagated Juvenile UCR Chinook	Total Mortality
WDOT - 1252	12	1	0	0	1
USFS - 1292	34	1	0	0	1
NRC - 1293	4	0	0	0	0
Totals	**50**	**2**	**0**	**0**	**2**

Methow River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Chinook	Mortality of Naturally-Spawned Juvenile UCR Chinook	Non-lethal Take of Artificially-Propagated Juvenile UCR Chinook	Mortality of Artificially-Propagated Juvenile UCR Chinook	Total Mortality
Douglas PUD - 1246	9,900	347	380	11	358
WDOT - 1252	12	1	20	1	2
USFS - 1292	34	1	133	4	5
NRC - 1293	4	0	2	0	0
Totals	**9,950**	**349**	**535**	**16**	**365**

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Wenatchee River in 2001 will be 38,475 (unpublished data, Chelan County PUD). The total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Wenatchee River is expected to be as high as 672,000 smolts annually when WDFW's planned hatchery supplementation program for the Wenatchee River Basin comes on line (WDFW 1998). Percent mortality of juvenile, endangered, naturally produced, UCR spring chinook salmon associated with the proposed actions to occur in the Wenatchee River Basin is 2.01 percent (774/38,475). Percent mortality of juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with the proposed actions to occur in the Wenatchee River Basin is 0.09 percent (592/672,000).

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Entiat River in 2001 will be 19,238 (unpublished data, Chelan County PUD); no ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles will be produced from the Entiat River in 2001 (unpublished information, WDFW). Percent mortality of juvenile, endangered, naturally produced, UCR spring chinook salmon associated with the proposed actions to occur in the Entiat River Basin is 0.01 percent (2/19,238). No juvenile, endangered, artificially-propagated, UCR spring chinook salmon will be taken in the Entiat River as a result of the proposed actions since there is no ESA-listed spring chinook salmon hatchery production in the Entiat River Basin.

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 25,650 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR spring chinook salmon juveniles from the Methow River in 2001 will be 424,000 (unpublished data, WDFW). Percent mortality of juvenile, endangered, naturally produced, UCR spring chinook salmon associated with the proposed actions to occur in the Methow River Basin is 1.36 percent (349/25,650). Percent mortality of juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with the proposed actions to occur in the Methow River Basin is 0.004 percent (16/424,000).

Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 35,685 juvenile, endangered, naturally-produced UCR spring chinook salmon that is proposed to occur in the tributary areas of the species' ESU and the annual non-lethal take of up to 20,110 juvenile, endangered, artificially-propagated, UCR spring chinook salmon that is proposed to occur in the tributary areas of the species' ESU, together with the annual lethal take of up to 1,121 juvenile, endangered, naturally-produced, UCR spring chinook salmon that is proposed to occur in the tributary areas of the species' ESU and the annual lethal take of up to 603 juvenile, endangered, artificially-propagated, UCR spring chinook salmon that is proposed to occur in the tributary areas of the species' ESU will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. This conclusion assumes that the loss of up to 1,724 UCR spring chinook salmon juveniles annually will not, individually or cumulatively, appreciably reduce the size or distribution of the affected populations or their ability to recover from the losses expected from the proposed actions. Adequate measures are in place to minimize the effects of the non-lethal take. The annual loss of up to 1,724 juveniles out of an estimated population of 367,454 in 2001 is not expected to appreciably reduce the reproductive capacity or distribution of any population of UCR spring chinook salmon or appreciably reduce their ability to recover.

2. Effects on Juvenile UCR Steelhead

Mainstem Columbia River

The following table summarizes the cumulative annual non-lethal take of juvenile, endangered, UCR steelhead that could potentially result in lethal take (collect for transport; capture, handle, release; capture, tag/mark, release) in the mainstem Columbia River. The observe/harass take category and the handling of ESA-listed fish carcasses will not be enumerated in the proposed permit actions and therefore, are not included in the table (these activities are not likely to result in any mortalities of ESA-listed steelhead). The following table also summarizes the cumulative annual lethal take of juvenile, endangered, UCR steelhead associated with the proposed actions that will occur in the mainstem Columbia River. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Steelhead	Mortality of Naturally-Spawned Juvenile UCR Steelhead	Non-lethal Take of Artificially-Propagated Juvenile UCR Steelhead	Mortality of Artificially-Propagated Juvenile UCR Steelhead	Total Mortality
Chelan PUD - 1115	7,357	147	21,293	426	573
Grant PUD - 1141	53,000	530	134,840	1,372	1,902
N. Wasco PUD - 1229	4	0	21	1	1
NWFSC - 1290	7	0	32	0	0
USGS - 1291	1,662	50	10,662	320	370
Totals	**62,030**	**727**	**166,848**	**2,119**	**2,846**

The proportional effect of annual juvenile steelhead mortalities resulting from the proposed actions that occur in the mainstem Columbia River was estimated by dividing the number of estimated mortalities by the estimated annual juvenile smolt abundance for the ESU as a whole. ESA-listed steelhead smolt abundance was estimated using an algorithm developed by NMFS' Northwest Fisheries Science Center for the 2001 juvenile steelhead outmigration season (Schiewe 2001; Appendix 4). Table 4 in Appendix 4 provides the ESA-listed juvenile steelhead outmigration estimates for 2001 at each of the hydropower dams on the mainstem Snake and Columbia Rivers. It should be noted that the juvenile outmigration estimates in Table 4 are provided in two scenarios that vary with regard to the extent of juvenile fish transportation and the relative amount of spill at the dams: Full transportation (no spill) and full transportation with spill. For the analyses in this consultation, the estimates under the full transportation (no spill) scenario will be used since that is the applicable scenario for the 2001 outmigration season. It should also be noted that the abundance estimates provided in Table 4 will be revised in future years as more complete information is acquired. One of the objectives of some of the proposed research addressed in this consultation is to obtain data that will be used to improve the precision of the abundance estimates in subsequent years.

From the above table, the cumulative annual mortality of juvenile UCR steelhead for the activities proposed to occur in the mainstem Columbia River is 727 naturally-spawned juveniles and 2,119 artificially-propagated juveniles. NMFS expects actual annual mortalities from each of the research projects to be less than the authorized amount because researchers have a tendency to overestimate their annual take in order to gain the flexibility to make inseason adjustments to research protocols in response to annual fluctuations in environmental conditions such as inriver water flows. Since juvenile salmonid abundance tends to vary considerably from year-to-year, high levels of take are also requested by researchers to be prepared for a year when ESA-listed juvenile fish are abundant and the actual take is likely to be relatively high. Also, high estimates of take are useful for NMFS' analyses of effects because they allow the inclusion of take associated with accidental events that could result in mortalities that exceed expectations.

To estimate the significance of the projected mortality levels, cumulative mortalities of UCR steelhead are divided by the outmigration runsize estimate at Rock Island Dam under the full transportation (no spill) scenario (from Table 4). The outmigration runsize estimate at Rock Island Dam is used because the majority of outmigrating UCR steelhead juveniles will have entered the mainstem river upstream of this location (more than 80 percent of this ESU's tributary habitat is upstream of Rock Island Dam, including the Wenatchee River system). In other words, Rock Island Dam is nearest to the point in the river system where most of the major tributaries end and the mainstem Columbia River begins for the UCR steelhead ESU. Percent mortality of juvenile, endangered, naturally produced, UCR steelhead associated with the proposed actions to occur in the mainstem Columbia River is 0.32 percent (727/224,300). Percent mortality of juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed actions to occur in the mainstem Columbia River is 0.32 percent (2,119/658,889).

NMFS concludes that the annual non-lethal take of up to 62,030 juvenile, endangered, naturally-produced, UCR steelhead that is proposed to occur in the mainstem Columbia River and the annual non-lethal take of up to 166,848 juvenile, endangered, artificially-propagated, UCR steelhead that is proposed to occur in the mainstem Columbia River, together with the annual

lethal take of up to 727 juvenile, endangered, naturally-produced, UCR steelhead that is proposed to occur in the mainstem Columbia River and the annual lethal take of up to 2,119 juvenile, endangered, artificially-propagated, UCR steelhead that is proposed to occur in the mainstem Columbia River will not appreciably reduce the likelihood of survival and recovery of the species in the wild. This conclusion assumes that the loss of up to 2,846 UCR steelhead juveniles annually will not, individually or cumulatively, appreciably reduce the size or distribution of the affected populations or their ability to recover from the losses expected from the proposed actions. Adequate measures are in place to minimize the effects of the non-lethal take. The annual loss of up to 2,846 juveniles out of an estimated population of 883,189 is not expected to appreciably reduce the reproductive capacity or distribution of any population of UCR steelhead or appreciably reduce their ability to recover from endangerment.

Tributary Areas

The following table summarizes the cumulative annual non-lethal take of juvenile, endangered, UCR steelhead that has the potential to result in lethal take (collect for transport; capture, handle, release; capture, tag/mark, release) associated with the proposed actions that will occur in the tributary areas of the species' ESU. The observe/harass take category and the handling of ESA-listed fish carcasses will not be enumerated in the proposed permit actions and therefore, are not included in the table (these activities are not likely to result in any mortalities of ESA-listed steelhead). The following table also summarizes the cumulative annual lethal take of juvenile, endangered, UCR steelhead associated with the proposed actions that will occur in the tributary areas of the ESU. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Steelhead	Mortality of Naturally-Spawned Juvenile UCR Steelhead	Non-lethal Take of Artificially-Propagated Juvenile UCR Steelhead	Mortality of Artificially-Propagated Juvenile UCR Steelhead	Total Mortality
USFWS - 1119	266	5	334	7	12
EPA - 1156	45	1	45	1	2
WDFW - 1203	11,100	333	28,100	843	1,176
Douglas PUD - 1246	460	14	170	5	19
WDOT - 1252	10	1	20	1	2
USFS - 1292	35	1	137	4	5
NRC - 1293	9	0	3	0	0
Totals	**11,925**	**355**	**28,809**	**861**	**1,216**

For the takes of juvenile, endangered, UCR steelhead that are proposed to occur in the tributary areas of the ESU, the analysis of cumulative impacts is best derived by determining the relative impacts of proposed activities on the specific populations of the species in the specific tributary areas where the activities are proposed to occur. The individual analyses for each proposed permit action to take place in a tributary area of the UCR steelhead ESU are located above under sections V.A. and V.B., *Analysis of the Effects of the Proposed Actions*.

The relative risk due to cumulative impacts could be significant to a specific population of steelhead if more than one of the proposed actions are to occur in the same geographic area or watershed within the boundaries of the ESU. The following 3 tables indicate the proposed non-lethal and lethal takes by major tributary watershed (Wenatchee River, Entiat River, Methow River). For the research projects that will occur in all three major tributary watersheds (indicated previously as occurring throughout the UCR Basin), this analysis will assume that the total requested take will occur entirely in each individual watershed and will be included in each table.

Wenatchee River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Steelhead	Mortality of Naturally-Spawned Juvenile UCR Steelhead	Non-lethal Take of Artificially-Propagated Juvenile UCR Steelhead	Mortality of Artificially-Propagated Juvenile UCR Steelhead	Total Mortality
EPA - 1156	45	1	45	1	2
WDFW - 1203	11,100	333	28,100	843	1,176
WDOT - 1252	10	1	20	1	2
USFS - 1292	35	1	137	4	5
NRC - 1293	9	0	3	0	0
Totals	**11,199**	**336**	**28,305**	**849**	**1,185**

Entiat River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Steelhead	Mortality of Naturally-Spawned Juvenile UCR Steelhead	Non-lethal Take of Artificially-Propagated Juvenile UCR Steelhead	Mortality of Artificially-Propagated Juvenile UCR Steelhead	Total Mortality
USFWS - 1119	266	5	334	7	12
WDFW - 1203	2,000	60	0	0	60
WDOT - 1252	10	1	20	1	2
USFS - 1292	35	1	137	4	5
NRC - 1293	9	0	3	0	0
Totals	**2,320**	**67**	**494**	**12**	**79**

Methow River

Proposed Permit Action	Non-lethal Take of Naturally-Spawned Juvenile UCR Steelhead	Mortality of Naturally-Spawned Juvenile UCR Steelhead	Non-lethal Take of Artificially-Propagated Juvenile UCR Steelhead	Mortality of Artificially-Propagated Juvenile UCR Steelhead	Total Mortality
WDFW - 1203	2,000	60	0	0	60
Douglas PUD - 1246	460	14	170	5	19
WDOT - 1252	10	1	20	1	2
USFS - 1292	35	1	137	4	5
NRC - 1293	9	0	3	0	0
Totals	**2,514**	**76**	**330**	**10**	**86**

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Wenatchee River in 2001 will be 25,786 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Wenatchee River in 2001 will be 153,573 (unpublished data, WDFW). Percent mortality of juvenile, endangered, naturally produced, UCR steelhead associated with the proposed actions to occur in the Wenatchee River Basin is 1.30 percent (336/25,786). Percent mortality of juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed actions to occur in the Wenatchee River Basin is 0.55 percent (849/153,573).

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Entiat River in 2001 will be 78,100 (unpublished data, Chelan County PUD); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Entiat River in 2001 will be 93,176 (unpublished data, WDFW). Percent mortality of juvenile, endangered, naturally produced, UCR steelhead associated with the proposed actions to occur in the Entiat River Basin is 0.09 percent (67/78,100). Percent mortality of juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed actions to occur in the Entiat River Basin is 0.013 percent (12/93,176). .

Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Methow River in 2001 will be 158,301 (unpublished data, Yakima Indian Nation); the estimated total production of ESA-listed, artificially-propagated, UCR steelhead juveniles from the Methow River in 2001 will be 520,318 (unpublished data, WDFW). Percent mortality of juvenile, endangered, naturally produced, UCR steelhead associated with the proposed actions to occur in the Methow River Basin is 0.05 percent (76/158,301). Percent mortality of juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed actions to occur in the Methow River Basin is 0.002 percent (10/520,318).

Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 11,925 juvenile, endangered, naturally-produced UCR steelhead and the annual non-lethal take

of up to 28,809 juvenile, endangered, artificially-propagated, UCR steelhead that is proposed to occur in the tributary areas of the species' ESU, together with the annual lethal take of up to 355 juvenile, endangered, naturally-produced, UCR steelhead and the annual lethal take of up to 861 juvenile, endangered, artificially-propagated, UCR steelhead that is proposed to occur in the tributary areas of the species' ESU will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. This conclusion assumes that the loss of up to 1,216 UCR steelhead juveniles annually will not, individually or cumulatively, appreciably reduce the size or distribution of the affected populations or their ability to recover from the losses expected from the proposed actions. Adequate measures are in place to minimize the effects of the non-lethal take. The annual loss of up to 1,216 juveniles out of an estimated population of 883,189 is not expected to appreciably reduce the reproductive capacity or distribution of any population of UCR steelhead or appreciably reduce their ability to recover from endangerment.

3. Effects on Adult UCR Spring Chinook Salmon and Adult UCR Steelhead

The following table summarizes the cumulative proposed non-lethal take of adult, endangered, UCR spring chinook salmon and adult, endangered, UCR steelhead that has the potential to result in lethal take (collect for transport; capture, handle, release; capture, tag/mark, release) associated with the proposed actions. The observe/harass take category and the handling of ESA-listed fish carcasses will not be enumerated in the proposed permit actions and therefore, are not included in the table (these activities are not likely to result in any mortalities of ESA-listed salmon or steelhead). The following table also summarizes the cumulative proposed lethal take of adult, endangered, UCR spring chinook salmon and adult, endangered, UCR steelhead associated with the proposed actions.

Proposed Permit Action	Non-lethal Take of Adult UCR Chinook	Mortality of Adult UCR Chinook	Non-lethal Take of Adult UCR Steelhead	Mortality of Adult UCR Steelhead
WDFW - 1114	0	0	400	4
Chelan PUD - 1115	50	0	0	0
Grant PUD - 1141	5	0	0	0
WDFW - 1203	100	1	130	1
Douglas PUD - 1246	0	0	5	0
Totals	**155**	**1**	**535**	**5**

These are estimates of the annual non-lethal and lethal take that could occur as a result of handling adults directly during salvage operations or for scientific research purposes. All of the non-lethal take of adult, endangered, UCR spring chinook salmon (up to 155 ESA-listed adults) and the non-lethal take of up to 100 adult, endangered, UCR steelhead (as part of WDFW's Permit 1203) are associated with proposed salvage operations. All of the lethal take of adult, endangered, UCR spring chinook salmon (up to 1 ESA-listed adult) and the lethal take of up to 1 adult, endangered, UCR steelhead (as part of WDFW's Permit 1203) are also associated with proposed salvage operations. As explained above in the analyses for each individual permit action involving salvage operations, the salvage or rescue of ESA-listed fish is intended to

enhance the survival of the fish over the alternative of a more substantial mortality rate if the fish are not assisted. In addition, salvage operations are not intended to emphasize one population type over another. The purpose of salvage operations is to assist the population types that are exposed to adverse environmental conditions where the need arises, whether at a dam on the mainstem Columbia River or in a tributary area.

Of the total non-lethal take of adult, endangered, UCR spring chinook salmon, up to 55 (out of 155) is proposed to occur at the dams on the mainstem Columbia River. No mortalities of ESA-listed UCR spring chinook salmon adults are proposed to occur as a result of the proposed take at the mainstem river dams. For the naturally-produced adult salmon proposed to be taken on the mainstem Columbia River, fish handlers will not be able to distinguish between the different populations when working at the mainstem river dams since the dams are located outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed actions on the specific wild populations of endangered UCR spring chinook salmon. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the proposed actions, this analysis is not sensitive enough to evaluate the effects due to proposed activities on ESA-listed, naturally-produced salmon at the population level. This cumulative take analysis assumes that the status of each affected population is the same as the ESU as a whole for the activities proposed to occur on the mainstem river. For the purpose of this analysis, the total take of ESA-listed UCR spring chinook salmon adults to result from the proposed actions on the mainstem Columbia River is compared with a recent 5-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. The most recent 5-year average adult UCR spring chinook salmon escapement (1996-2000) to Rock Island Dam is 5,968 fish (FPC 2001). A considerable proportion of these adults were hatchery-produced fish. For example, estimates of the hatchery contribution to natural spawning escapements were 39 percent in the Methow River Basin (Myers *et al.* 1998).

Of the total non-lethal take of adult, endangered, UCR steelhead, up to 400 (out of 535) is proposed to occur at Priest Rapids Dam by WDFW (Permit 1114) on the mainstem Columbia River. Up to 4 adult, endangered, UCR steelhead mortalities are proposed to occur associated with WDFW's radio tagging research project at Priest Rapids Dam (Permit 1114). For the naturally-produced adult steelhead proposed to be taken, WDFW researchers will not be able to distinguish between the different populations of UCR steelhead when working at Priest Rapids Dam since the dam is located outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on the specific wild populations of endangered UCR steelhead. Because of the uncertainty as to which ESA-listed fish populations will be impacted by the conduct of the proposed action, this analysis is not sensitive enough to evaluate the effects due to proposed research on ESA-listed, naturally-produced steelhead at the population level. This cumulative take analysis assumes that the status of each affected population is the same as the ESU as a whole. For the purpose of this analysis, the total take of ESA-listed UCR steelhead adults to result from the proposed action at Priest Rapids Dam is compared with a recent 5-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. The

most recent 5-year average adult UCR steelhead escapement (1996-2000) to Rock Island Dam is 7,374 fish (FPC 2001). A considerable proportion of these adults were hatchery-produced fish.

For the takes of adult, endangered, UCR spring chinook salmon that are proposed to occur in the tributary areas of the ESU, the analysis of cumulative impacts is best derived by determining the relative impacts of the proposed activities on the specific populations of the species in the specific tributary areas where the activities are proposed to occur. Of the total non-lethal take of adult, endangered, UCR spring chinook salmon, up to 100 (out of 155) is proposed to occur in the Wenatchee River Basin associated with WDFW's proposed salvage operations. The one lethal take of adult, endangered, UCR spring chinook salmon is also proposed to occur in the Wenatchee River Basin associated with WDFW's salvage operations. For the purpose of this analysis, the total take of ESA-listed UCR spring chinook salmon adults to result from WDFW's proposed salvage operations in the Wenatchee River Basin is compared with an estimate of the most recent 5-year average for the species' annual escapement to the Wenatchee River Basin. To derive the Wenatchee River escapement estimate, the most recent 5-year average of adult spring chinook salmon return numbers at Rocky Reach Dam is subtracted from the most recent 5-year average of adult spring chinook salmon return numbers at Rock Island Dam, since the Wenatchee River branches off of the Columbia River between Rock Island and Rocky Reach Dams. The reader should note that this approach assumes that the adult spring chinook salmon that migrate up to Rocky Reach Dam do not intend to return to the Wenatchee River; this assumption is not likely to be true for an unknown proportion of the UCR spring chinook salmon adults that return to Rocky Reach Dam each year. The most recent 5-year average adult UCR spring chinook salmon escapement (1996-2000) to Rock Island Dam is 5,968 fish; the most recent 5-year average adult UCR spring chinook salmon escapement (1996-2000) to Rocky Reach Dam is 2,000 (FPC 2001). A considerable proportion of these adults were hatchery-produced fish. Therefore, the estimate of the most recent 5-year average for the species' annual escapement to the Wenatchee River Basin is 3,968 (5,968 - 2,000).

For the takes of adult, endangered, UCR steelhead that are proposed to occur in the tributary areas of the ESU, the analysis of cumulative impacts is best derived by determining the relative impacts of the proposed activities on the specific populations of the species in the specific tributary areas where the activities are proposed to occur. Of the total non-lethal take of adult, endangered, UCR steelhead, up to 130 (out of 535) is proposed to occur in the Wenatchee River Basin (WDFW, Permit 1203) and up to 5 (out of 535) is proposed to occur in the Methow River Basin (Douglas County PUD, Permit 1246). The one lethal take of adult, endangered, UCR steelhead is proposed to occur in the Wenatchee River Basin associated with WDFW's salvage operations and/or scientific research activities. No lethal take of adult, endangered, UCR steelhead associated with Douglas County PUD's scientific research activities in the Methow River Basin are requested. For the purpose of this analysis, the total take of ESA-listed UCR steelhead adults to result from WDFW's proposed activities in the Wenatchee River Basin is compared with an estimate of the most recent 5-year average for the species' annual escapement to the Wenatchee River Basin. To derive the Wenatchee River escapement estimate, the most recent 5-year average of adult steelhead return numbers at Rocky Reach Dam is subtracted from the most recent 5-year average of adult steelhead return numbers at Rock Island Dam, since the Wenatchee River branches off of the Columbia River between Rock Island and Rocky Reach Dams. The reader should note that this approach assumes that the adult steelhead that migrate

up to Rocky Reach Dam do not intend to return to the Wenatchee River. This assumption is not likely to be true for an unknown proportion of the UCR steelhead adults that return to Rocky Reach Dam each year. The most recent 5-year average adult UCR steelhead escapement (1996-2000) to Rock Island Dam is 7,374 fish; the most recent 5-year average adult UCR steelhead escapement (1996-2000) to Rocky Reach Dam is 6,206 (FPC 2001). A considerable proportion of these adults were hatchery-produced fish. Therefore, the estimate of the most recent 5-year average for the species' annual escapement to the Wenatchee River Basin is 1,168 (7,374 - 6,206).

Based on the foregoing analysis, NMFS concludes that the non-lethal take of up to 155 adult, endangered, UCR spring chinook salmon and the lethal take of up to 1 adult, endangered, UCR spring chinook salmon annually will not appreciably reduce the likelihood of the survival and recovery of the species. NMFS likewise concludes that the non-lethal take of up to 535 adult, endangered, UCR steelhead and the lethal take of up to 5 adult, endangered, UCR steelhead annually will not appreciably reduce the likelihood of the survival and recovery of the species. Adequate measures are in place to minimize the effects of the non-lethal take. While the status of both species indicates that their respective biological requirements are not presently being met, NMFS nonetheless concludes that the mortality of up to 1 adult, endangered, UCR spring chinook salmon and the mortality of up to 5 adult, endangered, UCR steelhead will not substantially reduce the respective sizes of the populations within either the UCR spring chinook salmon ESU or the UCR steelhead ESU. Further, NMFS finds that the proposed activities discussed above will likely lead to better management and conservation of both endangered UCR spring chinook salmon and endangered UCR steelhead and/or enhance the survival and recovery of the species.

VI. Cumulative Effects

Cumulative effects are those effects of future Tribal, state, local or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. For the purpose of this analysis, the action area is that part of the upper Columbia River Basin described in section II above. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities will be reviewed through separate section 7 consultation processes. Non-Federal actions that require authorization under section 10 of the ESA, and that are not included within the scope of this consultation, will be evaluated in separate section 7 consultations.

Future Tribal, state, and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and frankly speculative. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives and proposed plans by government entities,

however, NMFS is unable to determine at this point in time whether any proposals will in fact result in specific actions.

A. State Actions

Each state in the Columbia River basin administers the allocation of water resources within its borders. Most streams in the basin are overappropriated even though water resource development has slowed in recent years. Washington closed the mainstem Columbia River to new water withdrawals, and is funding a program to lease or buy water rights. If carried out over the long term this might improve water quantity. The state governments are cooperating with each other and other governments to increase environmental protections, including better habitat restoration, hatchery and harvest reforms. NMFS also cooperates with the state water resource management agencies in assessing water resource needs in the Columbia River basin, and in developing flow requirements that will benefit listed fish. During years of low water, however, there could be insufficient flow to meet the needs of the fish. These government efforts could be discontinued or even reduced, so their cumulative effects on listed fish is unpredictable.

The state of Washington has various strategies and programs designed to improve the habitat of listed species and assist in recovery planning, including the Salmon Recovery Planning Act, a framework for developing watershed restoration projects. The state is developing a water quality improvement scheme through the development of TMDLs. As with the Oregon initiatives, these programs could benefit the ESA-listed species if implemented and sustained.

In the past, each state's economy was heavily dependent on natural resources, with intense resource extraction activity. Changes in the states' economies have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and significant growth in other economic sectors. Growth in new businesses is creating urbanization pressures with increased demands for buildable land, electricity, water supplies, waste disposal sites, and other infrastructure. Economic diversification has contributed to population growth and movement in the states, a trend likely to continue for the next few decades. Such population trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication and other infrastructure development. The impacts associated with economic and population demands will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated.

Some of the state programs described above are designed to address these impacts. Also, Washington enacted a Growth Management Act to help communities plan for growth and address growth impacts on the natural environment. If the programs continue they may help lessen some of the potential adverse effects identified above.

B. Local Actions

Local governments will be faced with similar but more direct pressures from population growth and movement. There will be demands for intensified development in rural areas as well as

increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time without certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat. Also there is little consistency among local governments in dealing with land use and environmental issues so that any positive effects from local government actions on listed species and their habitat are likely to be scattered throughout the action area.

In Washington, local governments are considering ordinances to address aquatic and fish habitat health impacts from different land uses. These programs are part of state planning structures. Some local government programs, if submitted, may qualify for a limit under the NMFS' ESA section 4(d) rule which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will not have measurable positive effects on listed species and their habitat, but may even contribute to further degradation.

C. Tribal Actions

Tribal governments will continue to participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat. The results from changes in Tribal forest and agriculture practices, in water resource allocations, and in changes to land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to Tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

D. Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts. Whether any of these private actions will occur is highly unpredictable, and the effects even more so.

E. Summary

Non-federal actions on ESA-listed species are likely to continue affecting the ESA-listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, and the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to

increase. Although state, Tribal, and local governments have developed plans and initiatives to benefit ESA-listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

VII. Conclusions

After reviewing the current status of the endangered UCR spring chinook salmon, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the permit actions, as proposed, is not likely to jeopardize the continued existence of endangered UCR spring chinook salmon or result in the destruction or adverse modification of its designated critical habitat.

Based on the analyses outlined in the *Analysis of the Effects of the Proposed Actions* section of this consultation, issuing the proposed section 10(a)(1)(A) scientific research and/or enhancement permit actions is expected to result in an annual proportional loss of no greater than 0.99 percent juvenile, endangered, naturally-produced, UCR spring chinook salmon (757/76,565; 76,565 is the naturally-produced UCR spring chinook salmon juvenile runsize estimate for 2001 at Rock Island Dam) and no greater than 2.16 percent juvenile, endangered, artificially-propagated, UCR spring chinook salmon (6,289/290,889; 290,889 is the artificially-propagated UCR spring chinook salmon juvenile runsize estimate for 2001 at Rock Island Dam) for the activities proposed to occur in the mainstem Columbia River. Based on the above analysis, issuing the proposed ESA section 10(a)(1)(A) scientific research and/or enhancement permit actions is expected to result in an annual proportional loss of no greater than 0.025 percent adult, endangered, UCR spring chinook salmon from the Wenatchee River Basin (1/3,968; 3,968 is an estimate of the UCR spring chinook salmon adult escapement to the Wenatchee River Basin in 2001 based on the most recent 5-year average escapement data collected at Rock Island and Rocky Reach Dams); no greater than 1.34 percent juvenile, endangered, naturally-produced, UCR spring chinook salmon (1,121/83,363; 83,363 is the combined estimate of the natural production of UCR spring chinook salmon in 2001 for the Wenatchee, Entiat, and Methow River Basins); and no greater than 0.14 percent juvenile, endangered, artificially-propagated, UCR spring chinook salmon (603/424,000; 424,000 is the estimated hatchery production of UCR spring chinook salmon in 2001 from the Methow River Basin, currently the only major tributary in the UCR Basin where hatchery production of ESA-listed UCR spring chinook salmon is occurring) for activities proposed to occur in the tributary areas of the ESU.

After reviewing the current status of the endangered UCR steelhead, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the permit actions, as proposed, is not likely to jeopardize the continued existence of endangered UCR steelhead or result in the destruction or adverse modification of its designated critical habitat.

Based on the analyses outlined in the *Analysis of the Effects of the Proposed Actions* section of this consultation, issuing the proposed section 10(a)(1)(A) scientific research and/or enhancement permit actions is expected to result in an annual proportional loss of no greater than 0.05 percent adult, endangered, UCR steelhead (4/7,374; 7,374 is an estimate of the UCR steelhead adult escapement to the UCR region in 2001 based on the most recent 5-year average escapement data collected at Rock Island Dam); no greater than 0.32 percent juvenile, endangered, naturally-produced, UCR steelhead (727/224,300; 224,300 is the naturally-produced UCR steelhead juvenile runsize estimate for 2001 at Rock Island Dam); and no greater than 0.32 percent juvenile, endangered, artificially-propagated, UCR steelhead (2,119/658,889; 658,889 is the artificially-propagated UCR steelhead juvenile runsize estimate for 2001 at Rock Island Dam) for the activities proposed to occur in the mainstem Columbia River. Based on the above analysis, issuing the proposed ESA section 10(a)(1)(A) scientific research and/or enhancement permit actions is expected to result in an annual proportional loss of no greater than 0.086 percent adult, endangered, UCR steelhead (1/1,168; 1,168 is an estimate of the UCR steelhead adult escapement to the Wenatchee River Basin in 2001 based on the most recent 5-year average escapement data collected at Rock Island and Rocky Reach Dams); no greater than 0.14 percent juvenile, endangered, naturally-produced, UCR steelhead (355/262,187; 262,187 is the combined estimate of the natural production of UCR steelhead in 2001 for the Wenatchee, Entiat, and Methow River Basins); and no greater than 0.11 percent juvenile, endangered, artificially-propagated, UCR steelhead (861/767,067; 767,067 is the combined estimate of the hatchery production of UCR steelhead in 2001 from the Wenatchee, Entiat, and Methow River Basins) for activities proposed to occur in the tributary areas of the ESU.

VIII. Incidental Take Statement

Section 9 and the regulations implementing section 4 of the ESA prohibit any take (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of ESA-listed species without a specific permit or exemption. When a proposed Federal action is found to be consistent with Section 7(a)(2) of the ESA (i.e., the action is found not likely to jeopardize the continued existence of an ESA-listed species or result in the destruction or adverse modification of critical habitat) and that action may incidentally take individuals of an ESA-listed species, NMFS will issue an Incidental Take Statement specifying the impact of any incidental take of the endangered or threatened species.

The Incidental Take Statement (ITS) provides reasonable and prudent measures that are necessary to minimize impacts, and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures. Incidental takes resulting from the agency action, including incidental takes caused by the agency's activities, are exempted from the take prohibition by section 7(o) of the ESA, but only if those takes are in compliance with the specified terms and conditions. The measure described below is non-discretionary and must be undertaken by NMFS for the exemption in section 7(o)(2) to apply. If NMFS (1) fails to cause the terms and conditions to be implemented or (2) fails to require the action agency to adhere to the terms and conditions of this ITS through enforcement, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental takes, the action agency must report the progress of its actions and their impacts on the species to NMFS as specified in this ITS [50 CFR 402.14(I)(3)].

The proposed ESA section 10(a)(1)(A) permits are for annual takes of endangered UCR spring chinook salmon and endangered UCR steelhead associated with scientific research and/or enhancement activities. Additional annual takes of ESA-listed chinook salmon and steelhead may occur incidental to the proposed activities or the funding of those activities by Federal agencies.

A. Amount or Extent of Incidental Take

Annual incidental takes of endangered UCR spring chinook salmon and endangered UCR steelhead can be specified for only one permit action within the scope of this consultation. The scientific research activities conducted by EPA/Dynamac (Permit 1156) may result in maximum annual incidental takes of ESA-listed species (see section II.A.5. above) as enumerated below:

1. Up to 5 adult, endangered, UCR spring chinook salmon may be captured, handled, and released incidental to EPA/Dynamac's scientific research activities.

2. Up to 8 adult, endangered, UCR steelhead may be captured, handled, and released incidental to EPA/Dynamac's scientific research activities.

The following estimated take levels are the maximum annual incidental takes that may occur during the conduct of all scientific research and/or enhancement activities that come under the scope of this consultation excluding those activities associated with Permit 1156. These estimates are derived using NMFS' prior experience with incidental take authorizations for anadromous fish species listed under the ESA. NMFS sets the following maximum annual incidental take levels:

1. Up to 15 adult, endangered, UCR spring chinook salmon may be captured, handled, and released incidental to scientific research and/or enhancement activities.

2. Up to 200 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 200 juvenile, endangered, artificially-propagated, UCR chinook salmon may be capture, handled, and released incidental to scientific research and/or enhancement activities.

3. Incidental mortalities must not exceed 10 juvenile, endangered, naturally-produced, UCR spring chinook salmon and 10 juvenile, endangered, artificially-propagated, UCR spring chinook salmon.

4. Up to 20 adult, endangered, UCR steelhead may be captured, handled, and released incidental to scientific research and/or enhancement activities.

5. Up to 200 juvenile, endangered, naturally-produced, UCR steelhead and up to 200 juvenile, endangered, artificially-propagated, UCR steelhead may be captured, handled, and released incidental to scientific research and/or enhancement activities.

6. Incidental mortalities must not exceed 10 juvenile, endangered, naturally-produced, UCR steelhead and 10 juvenile, endangered, artificially-propagated, UCR steelhead.

If these specified maximum take levels are reached or exceeded, NMFS may cause scientific research and/or enhancement activities to cease until this consultation is reinitiated or a new consultation is completed.

B. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of take of ESA-listed species. The action agencies are directed to (a) use all possible care to minimize the effects of the operations, (b) use experienced staff for all fish sampling operations, (c) cooperate with other researchers during this sampling and to report the results of the sampling to NMFS and all other interested parties, and (d) demonstrate that the project is fulfilling its purpose of generating important data on ESA-listed species.

C. Terms and Conditions

1. ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. When using gear that capture a mix of species, ESA-listed fish must be released as soon as possible after being captured to minimize the duration of handling stress.

2. ESA-listed juvenile fish must not be handled if the water temperature exceeds 70 degrees Fahrenheit at the capture site.

3. The Permit Holder must not intentionally kill or cause to be killed any ESA-listed species that may be incidentally taken, unless the permit allows a lethal take of the ESA-listed species.

4. Due caution must be exercised during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmon and steelhead when they are spawning. Whenever possible, walking in the stream must be avoided, especially in areas where ESA-listed salmon and/or steelhead are likely to spawn.

5. Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate to ascertain whether anadromous fish are merely present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible. If electroshocking equipment will be used to capture non-listed fish in areas where ESA-listed fish may be present, researchers must comply with NMFS' electrofishing guidelines.

6. Researchers must report whenever the authorized level of incidental take is exceeded, or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these

circumstances, NMFS may suspend research activities and/or reinitiate consultation to allow research activities to continue.

7. Researchers must submit a post-season report to NMFS summarizing the results of the research and the success of the research relative to its goals. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the manner of take, and the dates/locations of take.

IX. Conservation Recommendations

Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to develop additional information, or to assist Federal agencies in complying with their obligations under section 7(a)(1) of the ESA. NMFS believes the following conservation recommendation is consistent with these obligations, and therefore should be implemented:

> NMFS shall monitor actual annual takes of ESA-listed fish species associated with scientific research and/or enhancement activities, as provided to NMFS in annual reports or by other means, and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

X. Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of cumulative annual takes specified in the permits and/or the Incidental Take Statement of this consultation is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

XI. Magnuson-Stevens Act Essential Fish Habitat Consultation

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid,

minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

Thus, one of the objectives of this consultation is to determine whether the proposed actions—the issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities in Washington State—are likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, conservation recommendations will be provided.

A. Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species, and salmon off the coasts of Washington, Oregon and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook and coho salmon (PFMC 1999). For purposes of this consultation, freshwater EFH for salmon in Washington includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except upstream of the impassable dams. In the future, should subsequent analyses determine the habitat above any impassable dam is necessary for salmon conservation, the PFMC will modify the identification of Pacific salmon EFH (PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

B. Proposed Action and Action Area

For this EFH consultation, the proposed actions and action area are as described in detail above. The actions are the issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Upper Columbia River basin, including all river reaches accessible to salmon in Columbia River tributaries upstream to Chief Joseph dam in Washington. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts on these species' EFH from the above proposed action is based on this information.

C. Effects of the Proposed Action

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

D. Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect EFH Pacific salmon

E. EFH Conservation Recommendation

The Reasonable and Prudent Measures and the Terms and Conditions outlined above are applicable to designated salmon EFH. Therefore, NMFS recommends that those same Reasonable and Prudent Measures, and the Terms and Conditions be adopted as the EFH Conservation Recommendation for this consultation.

F. Statutory Response Requirement

Section 305(b)(4)(B) of the MSA and implementing regulations at 50 CFR section 600.920 require a Federal action agency to provide a detailed, written response to NMFS within 30 days after receiving an EFH conservation recommendation. The response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the impact of the activity on EFH. If the response is inconsistent with a conservation recommendation from NMFS, the agency must explain its reasons for not following the recommendation.

G. Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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Appendix 1: Special Conditions to be Contained in Scientific Research Permits

1. Each ESA-listed fish handled out-of-water must be anesthetized. Anesthetized fish must be allowed to recover (e.g. in a recovery tank) before being released. Fish that are simply counted must remain in water but do not need to be anesthetized.

2. ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. When using gear that capture a mix of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net that holds water during transfer, whenever necessary to prevent the added stress of an out-of-water transfer.

3. ESA-listed juvenile fish must not be handled if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. To minimize the lateral transfer of pathogens, a sterilized needle must be used for each individual injection when PIT-tagging ESA-listed fish.

5. The Permit Holder must provide plans for future undefined projects and/or changes in sampling locations or research protocols and obtain approval from NMFS prior to implementation.

6. The Permit Holder must not intentionally kill or cause to be killed any ESA-listed species authorized to be taken by the permit, unless the permit allows a lethal take of the ESA-listed species.

7. Due caution must be exercised during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided, especially in areas where ESA-listed salmonids are likely to spawn.

8. Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate to ascertain whether anadromous fish are merely present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible.

9. Researchers using backpack electroshocking equipment to collect ESA-listed fish must comply with NMFS' backpack electrofishing guidelines.

Appendix 2: Reporting and Annual Authorization Requirements to be Contained in Scientific Research Permits

For the duration of the permit, work in each succeeding year is contingent upon submission and approval of a report on the preceding year's scientific research activities. The report must include:

(1) A detailed description of activities conducted under the permit including the total number of fish taken from each salmonid run, an estimate of the number of ESA-listed fish taken from each salmonid run, the manner of take, and the dates/locations of take.

(2) Measures taken to minimize disturbances to ESA-listed fish and the effectiveness of these measures, the condition of ESA-listed fish taken and used for the research, a description of the effects of research activities on the subject species, the disposition of ESA-listed fish in the event of mortality, and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities;

(3) Any problems that may have arisen during the research activities and a statement as to whether or not the research activities had any unforeseen effects.

(4) A description of how all take estimates were derived.

(5) Any preliminary analyses of the data.

(6) Steps that have been and will be taken to coordinate the research with that of other researchers.

(7) If an electroshocker was used for fish collection, a copy of the logbook must be included with the report.

Appendix 3: Biological Requirements, Status, and Trends: Upper Columbia River Spring Chinook Salmon, Upper Columbia River Steelhead

I. Species Descriptions and Critical Habitat Designations

A. Chinook Salmon

Upper Columbia River Spring-Run Chinook Salmon (*Oncorhynchus tshawytscha*)
The upper Columbia River (UCR) spring-run chinook salmon evolutionarily significant unit (ESU), listed as endangered on March 24, 1999 (64 FR 14308), includes all natural-origin, stream-type chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River Basins. All chinook salmon in the Okanogan River are apparently ocean-type and are considered part of the UCR summer- and fall-run ESU. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White Rivers and Nason Creek. Critical habitat was designated for UCR spring-run chinook salmon on December 28, 1993 (58 FR 68543).

B. Steelhead

Upper Columbia River Steelhead (*Oncorhynchus mykiss*)
The UCR steelhead ESU, listed as endangered on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S./Canada border. The Wells Hatchery stock is included among the listed populations. Critical habitat was designated for UCR steelhead on February 16, 2000 (65 FR 7764).

II. General Life Histories

A. Chinook Salmon

The chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska, in North America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, combinations of seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (*O. nerka*), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Gilbert (1912) initially described two generalized freshwater life-history types: "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for ocean-type and stream-type to describe two distinct races of chinook salmon. Healey's approach incorporates life-history traits, geographic distribution, and genetic

differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby not emigrating to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate regarding the degree to which this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers *et al.* (1998) and Healey (1991).

B. Steelhead

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby *et al.* 1996, Nickelson *et al.* 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson *et al.* 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson *et al.* 1992). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby *et al.* 1996, Nickelson *et al.* 1992), migrate to spawning areas, and then spawn in late winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Multiple spawnings for steelhead range from 3 percent to 20 percent of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut

banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973), is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992).

Juveniles rear in freshwater from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in freshwater (Busby *et al.* 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby *et al.* 1996). Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby *et al.* 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy *et al.* 1990, Pearcy 1992).

III. Population Dynamics and Distribution

The following sections provide specific information on the distribution and population structure (size, variability, and trends of the stocks or populations) of endangered UCR spring chinook salmon and endangered UCR steelhead. Most of the information comes from observations made in terminal, freshwater areas, which may be distinct from the action area. This focus is appropriate because the species status and distribution can only be measured at this level of detail as adults return to spawn.

A. Chinook Salmon

Upper Columbia River Spring-Run Chinook Salmon

The UCR spring-run chinook salmon ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. UCR spring-run chinook salmon have a stream-type life history. Adults return to the Wenatchee River from late March through early May, and to the Entiat and Methow Rivers from late March through June. Most adults return after spending 2 years in the ocean, although 20 percent to 40 percent return after 3 years at sea. Like Snake River spring/summer chinook salmon, UCR spring-run chinook salmon experience very little ocean harvest. Peak spawning for all three populations occurs from August to September. Smolts typically spend 1

year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers *et al.* 1998). The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the upper Columbia River region.

Three independent populations of spring-run chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow River Basins (Ford *et al.* 1999). The number of natural-origin fish returning to each subbasin is shown in Table 1. The National Marine Fisheries Service (NMFS) recently proposed interim recovery abundance levels and cautionary levels (i.e., interim levels still under review and subject to change). Ford *et al.* (1999) characterize cautionary levels as abundance levels that the population fell below only about 10 percent of the time during a historical period when it was considered to be relatively healthy. Escapements for UCR spring-run chinook salmon have been substantially below the cautionary levels in recent years, especially during 1995, indicating increasing risk to and uncertainty about the population's future status. On the other hand, preliminary returns for 1999, the primary return year for the 1995 brood, indicate that although they were low, returns were still substantially higher than the estimated cohort replacement level. Very strong 1999 jack returns suggest that survival rates for the 1996 brood will be high, as well. A total of 4,500 natural-origin UCR spring-run chinook salmon is expected to return to the mouth of the Columbia River during 2000 with a corresponding number expected to return to each subbasin (accounting for expected harvest, inter-dam loss, and prespawning mortality) at approximately its respective cautionary level (Table 1).

Table 1. Estimates of the number of natural-origin fish returning to subbasins for each independent population of UCR spring-run chinook salmon and preliminary interim recovery abundance and cautionary levels.

Year	Wenatchee River[1]	Entiat River	Methow River
1979	1,154	241	554
1980	1,752	337	443
1981	1,740	302	408
1982	1,984	343	453
1983	3,610	296	747
1984	2,550	205	890
1985	4,939	297	1,035
1986	2,908	256	778
1987	2,003	120	1,497
1988	1,832	156	1,455
1989	1,503	54	1,217

Year	Wenatchee River[1]	Entiat River	Methow River
1990	1,043	223	1,194
1991	604	62	586
1992	1,206	88	1,719
1993	1,127	265	1,496
1994	308	74	331
1995	50	6	33
1996	201	28	126
1997	422	69	247
1998	218	52	125
1999	119	64	73
Recovery	**3,750**	**500**	**2,000**
Cautionary	**1,200**	**150**	**750**

Source: Cooney (2000)

[1] Estimates for the Wenatchee River exclude Icicle Creek/Leavenworth NFH.

Six hatchery populations are included in the ESA-listed ESU; all six are considered essential for recovery. Recent artificial production programs for fishery enhancement and hydrosystem mitigation have been a concern because a non-native (Carson Hatchery) stock was used. However, programs have been initiated to develop locally-adapted brood stocks to supplement natural populations. Facilities where problems with straying and interactions with natural stock are known to occur are phasing out the use of Carson stock. Captive broodstock conservation programs are under way in Nason Creek and White River (the Wenatchee River Basin) and in the Twisp River (Methow River Basin) to prevent the extinction of those spawning populations. All spring chinook salmon passing Wells Dam in 1996 and 1998 were trapped and brought into the hatchery to begin a composite-stock supplementation program for the Methow River Basin.

For the UCR spring chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[2] ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b). NMFS has also estimated median population growth rates and the risk of absolute extinction for the three spawning populations identified by Ford *et al.* (1999), using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100

[2] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

years ranges from 0.97 for the Methow River to 1.00 for the Methow and Entiat Rivers (Table B-5 in McClure et al. 2000b). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of extinction within 100 years is 1.00 for all three spawning populations (Table B-6 in McClure et al. 2000b).

NMFS has also used population risk assessments for UCR spring chinook salmon and steelhead ESUs from the draft quantitative analysis report (QAR; Cooney 2000). Risk assessments described in that report were based on Monte Carlo simulations with simple spawner/spawner models that incorporate estimated smolt carrying capacity. Population dynamics were simulated for three separate spawning populations in the UCR spring chinook salmon ESU, the Wenatchee, Entiat, and Methow River populations. The QAR assessments showed extinction risks for UCR spring chinook salmon of 50 percent for the Methow River, 98 percent for the Wenatchee River, and 99 percent for the Entiat River spawning populations. These estimates are based on the assumption that the median return rate for the 1980 brood year to the 1994 brood year series will continue into the future.

B. Steelhead

Upper Columbia River Steelhead

UCR steelhead inhabit the Columbia River reach and its tributaries upstream of the Yakima River. This region includes several rivers that drain the east slopes of the Cascade Mountains and several that originate in Canada (only U.S. populations are included in the ESU). Dry habitat conditions in this area are less conducive to steelhead survival than in many other parts of the Columbia River Basin (Mullan *et al.* 1992a). Although the life history of this ESU is similar to that of other inland steelhead, smolt ages are some of the oldest on the West Coast (up to 7 years old), probably due to the ubiquitous cold water temperatures (Mullan *et al.* 1992b). Adults spawn later than in most downstream populations, remaining in freshwater up to a year before spawning.

Although runs from 1933 through 1959 may have already been affected by fisheries in the lower river, dam counts suggest a pre-fishery run size of more than 5,000 adults above Rock Island Dam. The return of UCR natural-origin steelhead to Priest Rapids Dam declined from a 5-year average of 2,700 beginning in 1986 to a 5-year average of 900 beginning in 1994 (FPC 2000; Table 2). The escapement goal for natural-origin fish is 4,500. Most current natural production occurs in the Wenatchee and Methow River systems, with a smaller run returning to the Entiat River. Very limited spawning also occurs in the Okanagan River Basin. Most of the fish spawning in natural production areas are of hatchery origin. Indications are that natural populations in the Wenatchee, Methow, and Entiat Rivers are not self-sustaining.

The entire ESU has been subjected to heavy hatchery influence; stocks became thoroughly mixed as a result of the Grand Coulee Maintenance Project, which began in the 1940s (Fish and Hanavan 1948, Mullan *et al.* 1992a). Recently, as part of the development of the Mid-Columbia Habitat Conservation Plan (HCP), it was determined that steelhead habitat within the range of the ESU was overseeded, primarily due to the presence of Wells Hatchery fish in excess of those

collected for broodstock. This would partially explain recent observations of low natural cohort replacement rates (0.3 for populations in the Wenatchee River and no greater than 0.25 for populations in the Entiat River; Bugert 1997). The problem of determining appropriate levels of hatchery output to prevent negative effects on natural production is a subject of analysis and review in the Mid-Columbia Quantitative Analytical Report (Cooney 2000). In the meantime, given these uncertainties, efforts are under way to diversify broodstocks used for supplementation and to minimize the differences between hatchery and natural-origin fish (as well as other concerns associated with supplementation). The best use for the Wells Hatchery program in the recovery process is yet to be defined and should be integrated with harvest activities and recovery measures to optimize the prospects for recovery of the species.

Due to data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow River system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100 percent. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35 percent for the Wenatchee/Entiat River and 28 percent for the Methow River populations. At a hatchery effectiveness of 0.75, risks of 100 percent were projected for both populations.

For the UCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[3] ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000b). NMFS has also estimated the risk of absolute extinction for the aggregate UCR steelhead population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.25 (Table B-5 in McClure *et al.* 2000b). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure *et al.* 2000b).

Table 2. Adult summer steelhead counts at Priest Rapids, Rock Island, Rocky Reach, and Wells Dams (FPC 2000).

	Priest Rapids		Rock Island	Rocky Reach	Wells
Year	Count	Wild Origin	Count	Count	Count
1977	9,812		9,925	7,416	5,382
1978	4,545		3,352	2,453	1,621
1979	8,409		7,420	4,896	3,695

[3] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

1980	8,524		7,016	4,295	3,443
1981	9,004		7,565	5,524	4,096
1982	11,159		10,150	6,241	8,418
1983	31,809		29,666	19,698	19,525
1984	26,076		24,803	17,228	16,627
1985	34,701		31,995	22,690	19,757
1986	22,382	2,342	22,867	15,193	13,234
1987	14,265	4,058	12,706	7,172	5,195
1988	10,208	2,670	9,358	5,678	4,415
1989	10,667	2,685	9,351	6,119	4,608
1990	7,830	1,585	6,936	5,014	3,819
1991	14,027	2,799	11,018	7,741	7,715
1992	14,208	1,618	12,398	7,457	7,120
1993	5,455	890	4,591	2,815	2,400
1994	6,707	855	5,618	2,823	2,138
1995	4,373	993	4,070	1,719	946
1996	8,376	843	7,305	5,774	4,127
1997	8,948	785	7,726	7,726	4,107
1998	5,837	—	4,962	4,442	2,668
1999	8,456[1]	1,428[1]	6,361	4,815	3,557

[1] Priest Rapids counts for 1999 from Brown (1999).

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Appendix 4: Juvenile Salmon and Steelhead Collection and Transport Numbers

Table 3. Juvenile collection at each of eight mainstem collection facilities in 2001 under full transportation and transportation with spill scenarios.

	Full Transportation (No Spill) Scenario				Transportation with Spill Scenario			
	Chinook salmon				Chinook salmon			
	Spring/Summer		Fall	Sockeye	Spring/Summer		Fall	Sockeye
	Wild	Hatchery	Subyearling	salmon	Wild	Hatchery	Subyearling	salmon
Total fish collected at:*								
Lower Granite	1,740,616	1,740,616	836,950	10,218	1,235,837	1,235,837	820,211	5,279
Little Goose	713,830	713,830	308,150	3,985	680,842	680,842	252,546	3,056
Lower Monumental	254,557	254,557	144,830	966	354,264	354,264	183,045	2,172
Ice Harbor**	155,311	155,311	73,320	521	320,305	320,305	77,675	2,481
Columbia River								
Wells***	333,027	333,027	NA	NA	333,027	333,027	NA	NA
Rocky Reach***	628,662	628,662	NA	NA	628,662	628,662	NA	NA
Rock Island***	1,933,298	1,933,298	NA	NA	1,933,298	1,933,298	NA	NA
Wanapum***	1,739,968	1,739,968	NA	NA	1,739,968	1,739,968	NA	NA
Priest Rapids***	1,565,971	1,565,971	NA	NA	1,565,971	1,565,971	NA	NA
McNary****	2,446,509	2,446,509	7,632,121	583,008	1,213,078	1,213,078	5,583,066	583,008
John Day** ****	704,454	704,454	2,592,319	1,129,324	350,939	350,939	1,718,128	229,629
The Dalles** ****	780,292	780,292	1,388,742	677,594	1,260,034	1,260,034	1,070,263	677,594
Bonneville (I & II combined)** *****	2,320,466	2,320,466	5,943,481	609,835	1,341,714	1,341,714	4,582,048	271,377
---To the tailrace of Bonneville	5,801,165	5,801,165	19,811,603	1,524,587	6,880,585	6,880,585	18,856,164	1,524,587
---To Tongue Point*****	23,704,323	23,704,323	38,571,680	2,122,764	23,166,452	23,166,452	35,533,058	2,118,103
Total listed fish at:								
Lower Granite	286,920	308,218	515,695	9,185	203,913	218,829	505,381	4,746
Little Goose	131,062	124,035	189,869	3,582	118,818	119,411	155,609	2,747
Lower Monumental	55,447	82,087	41,174	868	66,158	91,718	59,553	1,953
Ice Harbor**	43,083	45,709	20,844	469	67,187	80,386	25,272	2,231
Columbia River								
Wells***	25,650	276,407	NA	NA	25,650	276,407	NA	NA
Rocky Reach***	42,322	248,766	NA	NA	42,322	248,766	NA	NA
Rock Island***	76,565	290,889	NA	NA	76,565	290,889	NA	NA
Wanapum***	68,908	261,800	NA	NA	68,908	261,800	NA	NA
Priest Rapids***	62,018	235,620	NA	NA	62,018	235,620	NA	NA
McNary****	96,353	224,497	22,581	562	57,471	122,078	20,007	729
John Day** ****	13,008	30,307	3,192	76	12,490	26,530	4,992	287
The Dalles** ****	7,805	18,184	1,710	46	32,117	68,221	3,110	848
Bonneville (I & II combined)** *****	147,898	16,366	705,152	41	82,767	29,932	572,193	340
---To the tailrace of Bonneville	369,746	40,915	2,350,506	103	424,448	153,498	2,354,705	1,907
---To Tongue Point*****	4,453,192	769,385	12,957,851	14,300	4,419,971	700,029	8,643,042	12,083
Percent listed fish at:								
Lower Granite	16.48%	17.71%	61.62%	89.89%	16.50%	17.71%	61.62%	89.89%
Little Goose	18.36%	17.38%	61.62%	89.89%	17.45%	17.54%	61.62%	89.89%
Lower Monumental	21.78%	32.25%	28.43%	89.89%	18.67%	25.89%	32.53%	89.89%
Ice Harbor**	27.74%	29.43%	28.43%	89.89%	20.98%	25.10%	32.53%	89.89%
Columbia River								
Wells***	7.70%	83.00%	NA	NA	7.70%	83.00%	NA	NA
Rocky Reach***	6.73%	39.57%	NA	NA	6.73%	39.57%	NA	NA
Rock Island***	3.96%	15.05%	NA	NA	3.96%	15.05%	NA	NA
Wanapum***	3.96%	15.05%	NA	NA	3.96%	15.05%	NA	NA
Priest Rapids***	3.96%	15.05%	NA	NA	3.96%	15.05%	NA	NA
McNary****	3.94%	9.18%	0.30%	0.10%	4.74%	10.06%	0.36%	0.13%
John Day** ****	1.85%	4.30%	0.12%	0.01%	3.56%	7.56%	0.29%	0.13%
The Dalles** ****	1.00%	2.33%	0.12%	0.01%	2.55%	5.41%	0.29%	0.13%
Bonneville (I & II combined)** *****	6.37%	0.71%	11.86%	0.01%	6.17%	2.23%	12.49%	0.13%
---To the tailrace of Bonneville	6.37%	0.71%	11.86%	0.01%	6.17%	2.23%	12.49%	0.13%
---To Tongue Point*****	18.79%	3.25%	33.59%	0.67%	19.08%	3.02%	24.32%	0.57%

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not established at this time. Also, there is no transportation from these dams

**** Note: (See next page)

***** Note: (See next page)

**** Note: The percentage of listed wild and hatchery spring/summer and fall chinook salmon at McNary, John Day, and The Dalles Dams are: For example, If you handle 1,000 yearling chinook salmon at Tongue Point, under the Full Transportation with spill scenario (Table 7), 19.08% of them will be listed wild fish, or 191 fish. To these 191 fish, you would apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 191 x 0.1003 = 19; UCR, 191 x 0.0095 = 2; etc).

Spring/Summer	**Full Transportation**		**Full Transportation with spill**	
chinook salmon	**Wild**	**Hatchery**	**Wild**	**Hatchery**
SR	53.66	24.40	64.34	36.20
UCR	46.34	75.60	35.66	63.80
LCR - Springs	---	---	---	---
UWR	—	—	—	—
Fall				
chinook salmon				
SR	100.00	---	100.00	---
LCR - Tule falls	---	---	---	---
LCR - Late run falls	---	---	---	---

***** Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.

The percentage of listed wild and hatchery spring/summer and fall chinook salmon at and downstream of Bonneville Dam are:

Spring/Summer	**Full Transportation**		**Full Transportation with spill**	
chinook salmon	**Wild**	**Hatchery**	**Wild**	**Hatchery**
SR	2.55	24.40	10.95	36.20
UCR	2.20	75.60	6.07	63.80
LCR - Springs	95.25	---	82.98	---
UWR	—	—	—	—
Fall chinook salmon				
SR	0.22	---	0.40	---
LCR - Tule falls	99.78	---	99.60	---
LCR - Late run falls	---	---	---	---

Tongue Point Spring/Summer	**Full Transportation**		**Full Transportation with spill**	
chinook salmon	**Wild**	**Hatchery**	**Wild**	**Hatchery**
SR	10.77	74.30	10.03	75.10
UCR	0.88	25.70	0.95	24.90
LCR - Springs	75.67	---	76.24	---
UWR	12.67	---	12.77	---
Fall				
chinook salmon				
SR	5.98	---	5.80	---
LCR - Tule falls	60.91	---	61.03	---
LCR - Late run falls	33.11	---	33.17	---

SR = Snake River ESU

UCR = Upper Columbia River ESU

LCR - Springs = Lower Columbia River ESU - Spring chinook

UWR = Upper Willamette River ESU

LCR - Tule falls = Lower Columbia River ESU - Tule fall chinook salmon

LCR - Late run falls = Lower Columbia River ESU - Late-run bright fall chinook salmon

Table 4. Juvenile steelhead trout collection at each of the mainstem collection facilities in 2001 under full transportation, no transportation, and transportation with spill scenarios.

	Full Transportation (No Spill) Scenario			Transportation with Spill Scenario		
	Wild steelhead trout	Listed hatchery steelhead trout	Wild chum salmon	Wild steelhead trout	Listed hatchery steelhead trout	Wild chum salmon
Total fish collected at:*						
Lower Granite	6,237,382	6,237,382	0	3,742,429	3,742,429	0
Little Goose	1,276,489	1,276,489	0	1,806,960	1,806,960	0
Lower Monumental	252,369	252,369	0	915,293	915,293	0
Ice Harbor**	112,051	112,051	0	683,928	683,928	0
Columbia River						
Wells***	778,379	778,379	0	778,379	778,379	0
Rocky Reach***	871,817	871,817	0	871,817	871,817	0
Rock Island***	963,995	963,995	0	963,995	963,995	0
Wanapum***	867,596	867,596	0	867,596	867,596	0
Priest Rapids***	780,836	780,836	0	780,836	780,836	0
McNary****	1,118,542	1,118,542	0	335,598	335,598	0
John Day** ****	342,978	342,978	0	476,537	476,537	0
The Dalles** ****	354,844	354,844	0	949,727	949,727	0
Bonneville (I & II combined)** *****	469,249	469,249	0	446,361	446,361	0
---To the tailrace of Bonneville	853,180	853,180	0	1,923,968	1,923,968	0
---To Tongue Point****	14,923,748	14,923,748	301,320	13,962,044	13,962,044	301,320
Total listed fish at:						
Snake River						
Lower Granite	660,682	0	0	396,409	0	0
Little Goose	137,287	0	0	192,083	0	0
Lower Monumental	32,471	0	0	99,713	0	0
Ice Harbor**	17,494	0	0	76,957	0	0
Columbia River						
Wells***	158,301	520,318	0	158,301	520,318	0
Rocky Reach***	220,571	561,462	0	220,571	561,462	0
Rock Island***	224,300	658,889	0	224,300	658,889	0
Wanapum***	201,870	593,000	0	201,870	593,000	0
Priest Rapids***	181,683	533,700	0	181,683	533,700	0
McNary****	228,547	484,355	0	56,602	93,642	0
John Day** ****	175,678	33,905	0	123,594	105,220	0
The Dalles** ****	153,794	21,796	0	252,331	180,035	0
Bonneville (I & II combined)** *****	170,956	21,578	0	113,262	75,182	0
---To the tailrace of Bonneville	310,830	39,233	0	488,198	324,062	0
---To Tongue Point****	1,726,689	523,588	301,320	1,604,286	417,704	301,320
Percent listed fish at:						
Snake River						
Lower Granite	10.59%	0.00%	----	10.59%	0.00%	----
Little Goose	10.76%	0.00%	----	10.63%	0.00%	----
Lower Monumental	12.87%	0.00%	----	10.89%	0.00%	----
Ice Harbor**	15.61%	0.00%	----	11.25%	0.00%	----
Columbia River						
Wells***	20.34%	66.85%	----	20.34%	66.85%	----
Rocky Reach***	25.30%	64.40%	----	25.30%	64.40%	----
Rock Island***	23.27%	68.35%	----	23.27%	68.35%	----
Wanapum***	23.27%	68.35%	----	23.27%	68.35%	----
Priest Rapids***	23.27%	68.35%	----	23.27%	68.35%	----
McNary****	20.43%	43.30%	----	16.87%	27.90%	----
John Day** ****	51.22%	9.89%	----	25.94%	22.08%	----
The Dalles** ****	43.34%	6.14%	----	26.57%	18.96%	----
Bonneville (I & II combined)** *****	36.43%	4.60%	----	25.37%	16.84%	----
---To the tailrace of Bonneville	36.43%	4.60%	----	25.37%	16.84%	----
---To Tongue Point****	11.57%	3.51%	100.00%	11.49%	2.99%	100.00%

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not established at this time. Also, there is no transportation from these dams

**** Note: The percentage of listed wild fish from each ESU at each Columbia River dam from McNary Dam to Bonneville Dam and at Tongue Point. All listed hatchery fish are from the Upper Columbia River ESU. For example, If you handle 1,000 steelhead at Tongue Point, under the Full Transportation with spill scenario (Table 9), 11.49% of them will be listed wild fish, or 115 fish. To these 115 fish, you would apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 115 x 0.4779 = 55; UCR, 115 x 0.0799 = 9; etc).

McNary Dam	**Full Transportation**	**Full Transportation with spill**
SR	8.27	28.39
UCR	64.39	50.27
MCR - Summers	27.34	21.34
MCR - Winters	---	---
LCR	---	---
UWR	—	—
John Day Dam		
SR	0.83	15.35
UCR	6.45	27.19
MCR - Summers	92.72	57.46
MCR - Winters	---	---
LCR	---	---
UWR	—	—
The Dalles Dam		
SR	0.61	12.94
UCR	4.72	22.91
MCR - Summers	88.77	60.69
MCR - Winters	5.90	3.47
LCR	---	---
UWR	—	—
Bonneville Dam		
SR	0.53	11.99
UCR	4.16	21.23
MCR - Summers	78.24	56.24
MCR - Winters	5.20	3.21
LCR	11.87	7.33
UWR	—	—
Tongue Point		
SR	49.29	47.79
UCR	9.00	7.99
MCR - Summers	16.69	17.26
MCR - Winters	0.88	0.94
LCR	13.33	14.37
UWR	10.81	11.65

SR = Snake River ESU; UCR = Upper Columbia River ESU; MCR - Summers = Mid Columbia River ESU summer steelhead; MCR - Winters = Mid Columbia River ESU winter steelhead; LCR = Lower Columbia River ESU; UWR = Upper Willamette River ESU